AN ECONOMIC ANALYSIS
OF CHANGES IN MILK PRODUCTION
IN THE NEW YORK MILKSHED

PURPOSE OF STUDY AND SAMPLING PROCEDURE

G. J. Conneman

Department of Agricultural Economics
Cornell University Agricultural Experiment Station
New York State College of Agriculture
A Contract College of the State University
Cornell University, Ithaca, New York
This is the first in a series of progress reports on Cornell University Agricultural Experiment Station State Project 58, An Economic Analysis of Long-Run Changes in Milk Production in the New York Milkshed. This project is being conducted by the Department of Agricultural Economics at Cornell in cooperation with the Departments of Agricultural Economics at the Universities of Connecticut, Delaware, Maryland, Pennsylvania State, Rutgers and Vermont, and the Market Administrator, New York-New Jersey Milk Marketing Area.

This report deals with the purpose and design of the study. Subsequent reports will cover factual information obtained from producers describing the nature of changes.

A second group of reports will provide basic analysis of the causes of change.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>PURPOSE OF STUDY</td>
<td>1</td>
</tr>
<tr>
<td>METHOD OF STUDY</td>
<td>2</td>
</tr>
<tr>
<td>SAMPLING DESIGN AND PROCEDURES</td>
<td>2</td>
</tr>
<tr>
<td>The Production Area for the New York-New Jersey Market</td>
<td>3</td>
</tr>
<tr>
<td>Farm Universe to be Sampled</td>
<td>4</td>
</tr>
<tr>
<td>Size of Sample</td>
<td>4</td>
</tr>
<tr>
<td>Stratification by Region</td>
<td>6</td>
</tr>
<tr>
<td>Segments or Groups of Producing Units</td>
<td>7</td>
</tr>
<tr>
<td>Mechanics of Drawing the Sample</td>
<td>7</td>
</tr>
<tr>
<td>FIELD PROBLEMS AND SAMPLE RESULTS</td>
<td>10</td>
</tr>
<tr>
<td>EVALUATION OF SAMPLE</td>
<td>11</td>
</tr>
<tr>
<td>Standard Deviation and Standard Error</td>
<td>11</td>
</tr>
<tr>
<td>Sample Estimates Compared with Independent Information About Parameters of the Farm Universe</td>
<td>12</td>
</tr>
<tr>
<td>Summary of Sample Evaluation</td>
<td>14</td>
</tr>
</tbody>
</table>
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INTRODUCTION

A knowledge of the response of milk supplies to price, technology, and other factors is important for intelligent decisions on the farm, in the market, and at the policy level. Dairy farmers need to know what changes are taking place, and are likely to occur in the future if they are to organize their farm businesses to make the best use of their resources. Cooperatives and other handlers of milk require such information to wisely plan for plant operations and disposal of milk to best advantage. Federal and state agencies charged with administering marketing orders need information on prospective future milk supplies in order to make correct pricing decisions, and thereby keep supply in line with demand.

Statistical data provide some insight into how milk production has changed in the past in the aggregate. Less is known about why changes occur, and the rate at which changes are likely to occur under different circumstances, particularly in the long run. Also, relatively little is known about the long-run response of dairy farmers to price and technology. A reliable mechanism for forecasting long-run changes in milk supplies is lacking.

Attempts to use time series analysis and budgetary studies to determine response have been only partially successful in revealing satisfactory answers. Lags in the changes in cow numbers, and lags by farmers in making decisions to invest past and future income have made this type of statistical approach difficult. In addition, aggregate data tend to hide some of the changes occurring on individual dairy farms, and where the changes occur among dairy farmers. For example, aggregate data show a steady decline in the number of dairy farms, but detailed data show that this has been the net result of some farmers discontinuing production while others have come into production.

Farmers, cooperatives, and federal and state agencies have become increasingly aware of the need for more and better information concerning the response of dairy farmers, and the relationship of milk supplies to price, technology, and physical and personal farm resources.

In the Spring of 1959, the Department of Agricultural Economics at Cornell University received a research grant from the New York-New Jersey Milk Market Administrator to make a study of supply response.

PURPOSE OF STUDY

The purpose of this study is to provide a better understanding of how and why milk production changes on individual farms in the New York-New Jersey Milkshed area, with special emphasis on price as a causal factor. Specifically the study seeks:

1. To describe the farms in the Milkshed area in terms of characteristics relevant to changes in milk output, and to establish meaningful groups of producers with respect to these characteristics.
2. To determine the important factors which influence the supply of milk forthcoming from an individual farm in order to measure the response of dairy farmers to price relationships and technological changes, and to learn the nature of the production responses of different groups of producers.

3. To formulate methods for forecasting milk supplies in the short-run and long-run.

4. To determine the manner in which dairymen adjust to changing conditions, and to ascertain what use is made of resources (land, buildings, operator) that are no longer used in the production of milk.

**METHOD OF STUDY**

The study was designed to follow in detail the changes in milk production made by a representative sample of milk producers during a five-year period, and to determine the reasons for these changes. Studying such a sample of dairy farms over a period of time should be helpful in explaining why changes take place in supply as well as for forecasting future changes in supply.

One advantage of this approach is in the opportunity to observe how farmers with different sizes of operations and differing in other characteristics react to changes in price, technology and other factors over time. This method tends to focus attention on the causes of changes within the aggregate rather than changes in the aggregate only.

The data obtained will be used to describe the nature of the changes taking place as well as to provide a basic analysis of the causes of change. A delineation of the important nonprice factors affecting supply, and the kinds of farm situations where these factors can be expected to work differently may then allow an approximation of the supply-price relationship. All of the information obtained will be used to estimate and appraise the capacity for change in milk output, the probable time-pattern of milk output change, and the change over time in milk output response characteristics of farms in the milkshed.

**SAMPLING DESIGN AND PROCEDURES**

The probability sample of milk producers selected for study was based on a geographic, systematic sample of small area segments drawn from the producing area after stratification by region. Each segment contained approximately 5 or 10 producers whose milk was priced by the New York-New Jersey Milk Order. A segment also included all other dairy and non-dairy farms that fell within the segment area.

Sampling was at a rate of 2.5 percent of the New York-New Jersey Order producers, or 1,250 producers. The sections which follow describe the sampling procedure in detail.
The Production Area for the New York-New Jersey Market

The geographic area of the New York Milkshed covers parts of six states: New York, New Jersey, Pennsylvania, Maryland, Delaware, and Vermont (see page 5). Dairy farmers within this area are associated with several different markets. However, the majority of producers in the entire area deliver milk to plants regulated by the New York-New Jersey Order.1/

All areas in New York State have producers whose milk is priced by the New York-New Jersey Order, except for a few counties in the western part of the State which are closely associated with the Rochester and Niagara Frontier Markets. In these markets milk is produced primarily for local use, and is priced by separate State Orders. In the area east of the Hudson River, the majority of producers currently deliver to markets in New England. Milk delivered by producers to local markets in several counties in northern and southwestern New York is not priced by any federal or state order. A relatively small number of producers in New York State sell unapproved milk to cheese factories and other manufacturing outlets.

Producers in Pennsylvania whose milk is priced by the New York-New Jersey Order are concentrated in two areas -- in the northern part, along the New York-Pennsylvania state line, and in an area in central Pennsylvania which extends from Williamsport on the north to the Pennsylvania-Maryland border on the south, and from Altoona to Reading, moving from west to east. The central Pennsylvania area also contains large numbers of producers who deliver to markets regulated by other federal orders, and to local (secondary) markets within Pennsylvania which are regulated by the Pennsylvania Milk Control Commission.

In New Jersey producers delivering to New York-New Jersey Order plants are located in the northern part of the state.

1/ The New York-New Jersey Milk Order is in fact a regulatory system consisting of a federal milk marketing order (No. 2) and concurrent orders issued by the State Milk Control Agencies of New York and New Jersey. These orders are administered by a joint agency, the Market Administrator, New York-New Jersey Milk Marketing Area.

The primary purpose of these orders is to fix minimum prices to be paid by handlers for milk produced for the specified marketing area. That marketing area includes New York City and immediately adjacent counties of New York State, as well as 13 counties of Northern New Jersey and all or parts of 35 counties of Upstate New York.

The production area for this market (New York-New Jersey Milkshed) embraces most of New York State as well as substantial parts of New Jersey and Pennsylvania, and relatively small areas in other neighboring states.
On many farms in the western part of New York State, the dairy enterprise is combined with grain and cash crops. On most farms in central Pennsylvania, milk production is found on farms where other livestock, cash crops, and grain crops are also important.

Farm Universe to be Sampled

U. S. Geological Survey topographic quadrangle maps showing the location of the milk houses of all New York-New Jersey Order producers were available from the Market Administrator’s office. In New York State, with the exception of the area east of the Hudson River, these maps also indicated the location of dairy farmers who delivered to other markets. On the topographic maps for other states, only the location of farmers delivering to plants under the New York-New Jersey Order was plotted. In June 1959, the New York-New Jersey Market Administrator reported that 50,338 producers were delivering to Order plants.

For sampling purposes, the farm universe was defined as all the producing units delivering milk under the New York-New Jersey Order in June 1959. The basic unit of production enumerated in this study is a producing unit. A producing unit is defined as consisting of that bundle of farm resources—land, buildings, cattle and machinery—under the single management and control of one or more operators. A producing unit may therefore include more than one farm, and all the milk cows under one management, even though the cows are milked in more than one barn.

An operator or producer is defined as an individual who runs a producing unit, and who delivers milk to market, however small the amount, including intermittent shippers. References in this report to farms or producers, unless otherwise noted, refer to producing units and operator(s) as defined above.

Size of Sample

A sample should be large enough to give reasonably precise estimates of important characteristics of the farm universe. A priori knowledge and certain intuitive judgments were used in selecting a sample of sufficient size to provide a comprehensive view of producers in the market and still be manageable in terms of time and costs.

Two farm characteristics of particular importance in a study of this type are cows per farm (producing unit), and pounds of milk sold per cow. To evaluate the acceptability of the sample chosen it seemed reasonable that production per cow as given by the sample should have a high probability of being within 150 pounds of the true production per cow. Similarly for cows per farm the sample estimates should have a high probability of being within one cow of the true number.

2/ The U. S. Geological Survey issues a series of topographic quadrangle maps which cover the United States. The country is divided into quadrangles bounded by parallels of latitude and meridians of longitude, and cover either 7-1/2 or 15 minutes of latitude and longitude. Topographic maps show features such as lakes, rivers, canals, swamps, mountains, hills, valleys, towns, cities, roads, railroads, etc., and state, county and town boundaries. Nearly half of the topographic maps used for sampling purposes in this study were issued since 1950, and only about one in ten was dated prior to 1939.
REGIONS IN THE NEW YORK-NEW JERSEY MILKSHED

Legend
1. Northern New York
2. Mohawk Valley Area
3. Eastern Plateau
4. Central Plateau
5. Western Plateau
6. Central Lakes Area
7. Central Pennsylvania
8. New Jersey Area
9. Eastern New York
10. Buffalo-Rochester Area

Regional Number
Non-agricultural
Past studies of dairy farms in New York State indicated that for pounds of milk sold per cow, the standard deviation was likely to be 2,000 pounds per cow. For cows per farm, the standard deviation might be approximately 20. Under this assumption, a sample of 1,250 producing units would assure a sample mean of being within 112 pounds of the actual amount of milk sold per cow 95 out of 100 times, and within 1.1 cows of the actual number of cows kept per farm. A sample of 1,600 farms would give estimates that, 95 percent of the time, would not depart from the true number of cows per farm by more than one, and from milk sold per cow by more than 98 pounds.

Budgetary limitations influenced the size of sample. The larger the number of producing units enumerated, the less information could be obtained on each unit under observation since the available budget was fixed. The gains from obtaining greater information on each producing unit were weighed against the advantages of obtaining greater accuracy in estimating producer or farm characteristics. The smaller sample of 1,250 producers (a sampling rate of 2.5 percent) was finally decided upon as one that would give satisfactory results as far as sampling precision was concerned, and would still allow a large amount of information to be obtained on each producing unit.

Stratification by Region

Ten regions were delineated in the New York-New Jersey Milkshed area for purposes of the study. The aim was to delineate areas within which the natural possibilities for dairy farming and alternative enterprises were similar or homogeneous. Present resources and potential future development were taken into account.

In defining these regions, use was made of soil maps, census data, type of farming studies, economic regions studies, climatic and topographic data, pricing zones, seasonality of milk production, and recent studies of trends in cow numbers and intensity of farming.

Milk producers in all of New York State with the exception of the area east of the Hudson River had been located on topographic maps by the Market Administrator’s office. In the area east of the Hudson River and in other states only New York-New Jersey Order producers had been located.

A large plastic-covered map of the milkshed area was prepared on which the number of producers on each topographic map was indicated. Tentative regional boundaries were sketched on this map, based on general knowledge of the areas. Boundaries as indicated by soil maps, type of farming areas, etc. were superimposed on this basic map. Final boundaries were determined after field observations. Political boundaries (state, county, township) were given only minor consideration in defining regions. In general, boundaries between regions were drawn to follow boundaries between topographic maps. An attempt was made to make regions of sufficient size so the sample obtained by using a uniform sampling rate in each region would be large enough to allow valid statements to be made about each region.

In two of the regions, major sub-regions existed that were large enough and important enough to be defined separately. These were the Black River Valley area of Region 1, and the eastern half of Region 4.
Three areas within New York State were classified as non-agricultural -- the Adirondack Mountains, the Catskill Mountains and the Tug Hill area. These areas are indicated by on the map on page 5. Relatively few dairy farms were located in these three areas.

The regions as defined for purposes of this study, cover all of New York State, and parts of Pennsylvania, New Jersey, Vermont, Delaware and Maryland. The final regional boundaries are indicated on the map on page 5.

Segments or Groups of Producing Units

Groups of producers in area segments were selected rather than individual producing units. One reason was to reduce travel time and interviewing costs. However, this was not the major consideration. The main advantage of area segments for this study is to allow the sample to be kept representative, and to reflect changes over time if the total milkshed is not enlarged. Segments make it possible for farms which were not producing milk at the outset to enter the sample at a later date. Segments also allow the measurement of the effects of farm consolidation. Also shifts between milk markets can be more effectively observed and analyzed using farms within segments.

One disadvantage of choosing groups of farms rather than individual farms is the possibility of reducing independent variability. Neighbors may tend to be more alike than non-neighbors. Several experimental check samples of individuals and segments were drawn and variability studied. Variability appeared to be nearly as great from farm to farm in the segments as among individual farms drawn at random.

The number of farms per segment represents a compromise of several objectives: high sampling efficiency, low interviewing costs, and the advantages of segments in reflecting market shifts, farm consolidation and new producers.

After extensive field testing, segments of ten farms were decided upon as giving good results from the standpoint of travel time, geographic distribution, etc. The only variation in this procedure was in the Central Lakes Area (Region 6) and in Central Pennsylvania (Region 7). In these two regions, segments of five producers delivering to New York-New Jersey Order plants were selected (and consequently twice as many segments in proportion to the number of farms) because of the wide dispersion of such producers in these two areas.

Although sampling was on the basis of producers delivering to New York-New Jersey plants, dairy farmers delivering to other markets and farms not producing milk were identified within each of the segments chosen.

Mechanics of Drawing the Sample

The mechanics of drawing the sample are outlined below and illustrated in figure 1 on page 8.
*Assuming random starting number of 269*
Regional boundaries were defined to include an area within which dairy farming and alternative enterprises were similar or homogeneous.

Each box represents a U.S. Geological topographic map. These maps show physical and geographic features such as lakes, rivers, canals, swamps, mountains, hills, valleys, towns, cities, roads, railroads, and town, county and state boundaries. An insert on actual scale shows what appears on a typical map. In addition to the features on these maps as issued, the location of all farmers who shipped milk was plotted. For example, the number 84 on map #2 indicated that 84 farms are located on that map, and delivered milk to a New York-New Jersey Order plant in May 1959.

Individual topographic maps within each region were numbered in a serpentine fashion going back and forth across the region. This was done to ensure geographic distribution of the segments throughout the region.

A table was compiled listing the number of the topographic map (#1, #2, ... in column 1) and the number of producers on each map (256, 84 ... in column 2).

The number of producers was accumulated in order to arrive at the total number in the region. (256 + 84 = 340; 340 + 150 = 490; ... 1970 + 78 = 2,048.) See column 3. (Within all the regional boundaries as shown on the colored map on page 5, the topographic maps contained the locations of approximately 50,000 producing units. This meant that to arrive at a sampling rate of 2.5 percent, a sample of 1,250 had to be drawn. This would involve selecting 125 segments containing ten producing units or farms, or twice as many where segments of five producers were used. To arrive at this desired result a "counting interval" had to be employed. At the desired sampling rate of 2.5 percent, a segment of ten producing units had to be selected from every 400 farms. Thus the counting interval in this instance was 400.)

In order to select the first topographic map in each region at random, a starting number had to be selected. For each region, a starting number was selected from Snedecor's Table of Random Numbers (this starting number could have been drawn out of a hat). To arrive at a sampling rate of 2.5 percent, the starting number had to be between 1 and 400, the counting interval. The number selected in the example on page 8 was 269.

Topographic maps were then selected for segmenting by the following procedure: with 269 as the starting number, topographic map #2 was chosen, then map #4 (269 + 400 = 669; the location of the 669th farm fell
on map #4, i.e., the counting interval of 400 was added to the randomly selected starting number in order to select the topographic map in which a segment would be chosen.) In the example, maps #2, 4, 8, 11, and 15 were chosen (see shaded blocks).

A fixed procedure was used to segment the topographic maps, and select one segment from each map. The number of farms per segment was kept as close to ten as possible, and the number of segments per map was in proportion to the number of farms on the map. (The total area and all producers located on a given topographic map had to be included in the segments into which the map was to be divided. For example, the 84 producers located on map #2 were divided into eight segments -- the segments included all the area shown by the map, and the 84 producers were divided into 8 groups or segments, most containing 10 producers, but some containing 9 or 11.)

Segment boundaries were drawn to include as much variability as practicable in each segment. A segment included the farm on the dead-end road, and the segment boundary was drawn to run half-way down the road to the next farm. Segments were drawn to cut across hills, valleys, roads and other natural geographic and topographic features. Segment boundaries also were drawn to be easily recognizable in the field. Cross roads, clear-cut bends in roads, railroad crossings, streams, cemeteries, churches, schools, or other clearly defined features were used to define segment boundaries.

After the systematically selected topographic map had been segmented according to the procedure outlined, the segments were numbered and one was selected at random.

The farms included within this segment were the ones to be studied.

This sampling procedure is the equivalent of dividing the entire milkshed into area segments of approximately ten producing units, and selecting the appropriate number of segments by a chance procedure that ensured geographic distribution of the segments. It took three men two months to draw the sample by the method described above.

FIELD PROBLEMS AND SAMPLE RESULTS

Relatively few problems were encountered in the field in locating segment boundaries, and deciding on the farms to be included or excluded from study. Undoubtedly, the method of defining segment boundaries by topographic and other features contributed to the lack of problems.

The number of New York-New Jersey Order producers per segment actually found in the field did not vary greatly from the expected number. In the segments designed to include ten such producers, 85 percent were found to contain 8 to 12. The range
was from 3 to 14. The segments expected to include five producers in western New York and central Pennsylvania contained 2 to 7 producers per segment. Eighty-six percent of these segments contained 4 to 6 New York-New Jersey Order producers. In total, 1,172 Order producers were enumerated in June 1960.

In addition to the producers sampled, farmers shipping to other markets and types of farms other than dairy were found in many sample segments. A total of 315 farms not delivering to plants under the New York-New Jersey Order were contained within the sample segments. The number of these farms varied widely from region to region, with the largest number occurring in Regions 5, 6, and 10 (the Niagara Frontier and Rochester markets) and in Region 7 in central Pennsylvania. Approximately 800 non-dairy units also were found within the sample areas. These “units” included crop farms, poultry farms, idle farms, part-time farms, and rural residences with a few acres of land.

Of the nearly 1,200 New York-New Jersey Order producers contacted during 1960, only 18 (or 1.5 percent) declined to supply physical information on their farm businesses. On subsequent visits, information has been obtained from 11 of these 18 producers.

EVALUATION OF SAMPLE

Several characteristics of the sample were evaluated to determine how closely estimates from the sample compared with parameters of the farm universe.

Standard Deviation and Standard Error

Various statistics were calculated on the frequency distributions for number of cows per farm, and pounds of milk sold per cow. The standard deviation and standard error of the mean are shown in table 1.

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Number of cows per farm</th>
<th>Pounds of milk sold per cow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard deviation (s)</td>
<td>18.7</td>
<td>2,132</td>
</tr>
<tr>
<td>Standard error of the mean (s_x)</td>
<td>.55</td>
<td>64</td>
</tr>
</tbody>
</table>

If the standard error of the mean is multiplied by two, and this is added to and subtracted from the sample mean, it gives a range within which one would expect the true mean of the population to fall, in 95 percent of such attempts to estimate the mean.
In this case the population mean for cows per farm would fall between 28 and 30 cows, and for milk sold per cow between 8,035 and 8,291.3

**Sample Estimates Compared with Independent Information About Parameters of the Farm Universe**

A comparison of sample data, estimates from the sample for the entire farm universe (the population), and population values obtained from other sources are shown in table 2 and discussed below.

Number of producers--As reported in the Market Administrator's Bulletin for the New York-New Jersey Milk Marketing Area, 49,460 “producers” delivered milk to plants regulated under Order 2 in June 1960. The number of producers, as reported by the Market Administrator actually refers to number of milk checks. For example, a father and son, who operate a dairy farm but receive separate checks, would be counted as two “producers”. Figures on sample producers indicated 6.2 percent more checks than producing units in June 1960, and 5.4 percent more checks than producing units in June 1961. Therefore, the number of producers reported by the Market Administrator must be reduced somewhat to obtain the number of producing units as defined in this study. Assuming that the number of “producers” exceeds the number of producing units by 6 percent, and adjusting accordingly, then an average of 45,780 producing units delivered milk to New York-New Jersey Order plants during the period June 1960 to May 1961 inclusive.

In June 1960 there were 1,172 sample producing units in the study; by June 1961 this figure had declined to 1,131. Thus, the average number of sample producing units during this period was 1,152. Assuming that these sample producers represent 2.5 percent (the sampling rate) of all producers, the estimates for the entire farm universe from the sample would be 46,080 producers. This compares to 45,780 as calculated above. These calculations would seem to indicate that the sample overestimates the number of producers by 300 or 0.7 percent. Part of this difference may be due to the method of adjusting the number of producers to conform to the definition of producing units.

Total amount of milk sold--The Bulletin reported that 10,757 million pounds of milk were delivered by producers to plants regulated by the New York-New Jersey Order during the period May 1, 1960 to April 30, 1961. During this same period all farms in the sample delivered 280 million pounds of milk. The estimate for the population from the sample would be 11,200 million pounds. On this basis, the sample overestimates the amount of milk by 443 million pounds or 4.1 percent.

Milk sold per cow--The average production per cow in New York State in 1960 as reported by the New York Crop Reporting Service was 8,150 pounds. For 1961, the production per cow was 8,440 pounds. A weighted average of the pounds of milk produced per cow reported by the Crop Reporting Service for New Jersey, New York,

\[
\bar{X} \pm 1.96 \frac{s}{\sqrt{n}} = 8,163 \pm 1.96 (0.55) = 28.0 \text{ to } 30.2 \text{ cows per farm is the range within which one expects the population mean to fall.}
\]

\[
\bar{X} \pm 1.96 \frac{s}{\sqrt{n}} = 8,035 \pm 1.96 (64) = 8,038 \text{ to } 8,288 \text{ pounds of milk sold per cow is the range within which one expects the population mean to fall.}
\]

\[3/\]
**TABLE 2. COMPARISON OF SAMPLE ESTIMATES AND PARAMETERS OF THE FARM UNIVERSE**

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Data from sample:</th>
<th>Population values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Sample amount</td>
<td>Estimates for the population</td>
</tr>
<tr>
<td>Producers</td>
<td>Number</td>
<td>1,152 a/</td>
<td>46,080 b/</td>
</tr>
<tr>
<td>Milk sold</td>
<td>Mil. lbs.</td>
<td>280 d/</td>
<td>11,200 e/</td>
</tr>
<tr>
<td>Milk sold per cow</td>
<td>Lbs.</td>
<td>8,321 g/</td>
<td>8,321 g/</td>
</tr>
</tbody>
</table>

a/ Average number of New York-New Jersey Order producers in the sample, June 1, 1960, and June 1, 1961.

b/ Assuming 2.5 percent sample, i.e., 1,152 x 40.

c/ Average number of producers for the 12-month period June 1960 to May 1961 as reported by the New York-New Jersey Market Administrator, adjusted by minus 6 percent for the difference in number of milk checks as compared to the number of "producing units". Sample figures indicated 6.2 percent more checks than producing units in June 1960, and 5.4 percent more checks than producing units in June 1961.

If an average of the number of producers in May-June 1960 and May-June 1961 had been adjusted by 6 percent, the total number of farms delivering milk would have been 45,818.

d/ Total pounds of milk sold by sample producers between May 1, 1960 and April 30, 1961.

e/ Assuming 2.5 percent sample, i.e., 280 x 40.

f/ Total pounds of milk delivered to New York-New Jersey Order plants during the period May 1960 to April 1961 inclusive.

g/ Calculated by dividing the total amount of milk sold by 1,070 sample producers (who delivered milk for the entire 12-month period, May 1960 to April 1961) by the average number of cows kept on these 1,070 farms. Average number of cows computed from total cows in June 1960, January 1961, and June 1961.

h/ Average pounds of milk produced per cow for the 1960 and 1961 calendar years, as reported by the New York Crop Reporting Service.

The use of the weighted average of pounds of milk produced per cow as reported in 1960 and 1961 by the Crop Reporting Service for New Jersey, New York, and Pennsylvania, would give a population value of 8,187 pounds produced per cow. Weights used were: .70 for New York State, .26 for Pennsylvania, and .04 for New Jersey. The weights were based on the percent of the number of cows on the sample farms in each of the three states.
and Pennsylvania for 1960-61 was 8,187 pounds. However, in both 1960 and 1961, production per cow in Pennsylvania areas not in the New York Milkshed was below production per cow in the Pennsylvania portion of the New York Milkshed. The 1,070 sample producers who delivered milk for the entire 12 months period between May 1960 and April 1961 sold 8,321 pounds of milk per cow.

Differences between the amount of milk produced and the amount sold are usually due to the amount used on farms including milk fed to calves, and milk consumed by the farmer and his family. However, the figures above would indicate that sample farmers had a higher amount of milk sold per cow than the Crop Reporting Service indicates for the amount produced per cow. This may be explained in part by the fact that in making production estimates, the CRS includes farms with only a few cows, which may sell little or no milk. Such farms would tend to have lower production per cow than farms which market milk. Farms that do not deliver milk to market are not represented in the sample used for this study.

Change in number of producers--The sample selected for this study permits changes in the number of producing units to be studied over time. The sample provides a means of tracing and analyzing change during the five-year period of study. Between June 1960 and June 1963, the Market Administrator's Bulletin for the New York-New Jersey Milk Marketing Area reported a change in the number of "producers" from 49,460 to 43,928, or a decrease of 11.2 percent. During the same three-year period, the number of producing units in the sample declined from 1,172 to 1,028, or 12.3 percent. This change in number of units delivering milk is a composite result of producers going out of production, producers coming into production, and producers shifting milk markets.

Summary of Sample Evaluation

The sampling procedure used appears to result in a sample that is acceptably representative of the farm universe being studied. This is indicated by the various comparisons made between the sample estimates and other information about the population parameters.

Differences in how various characteristics are defined, variation in the time period used for comparison, and uncertainty about the exact value of some population parameters create problems in evaluating the sample. The sample used for this study somewhat overestimates total milk production, and perhaps both the number of producers, and the amount of milk sold per cow. Accurate comparisons between sample estimates and parameters depend upon the validity of several adjustments made because of differences in definitions.