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The necessary supply of milk to meet the class 1 demand of the Knoxville, Tennessee market

Dormal Newberry

To the Graduate Council:

I am submitting herewith a thesis written by Dormal Newberry entitled "The necessary supply of milk to meet the class 1 demand of the Knoxville, Tennessee market." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

Stanton P. Parry, Major Professor

We have read this thesis and recommend its acceptance:

Irving Dubov, Charles L. Cleland

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

May 22, 1964

To the Graduate Council:

I am submitting herewith a thesis written by Dormal Newberry entitled "The Necessary Supply of Milk to Meet the Class I Demand of the Knoxville, Tennessee Market." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

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Major Professor

We have read this thesis and recommend its acceptance:

Irving Dicbor

Charles L. Allen

Accepted for the Council:

Hilton A. Smith
Dean of the Graduate School

THE NECESSARY SUPPLY OF MILK TO MEET THE CLASS I DEMAND OF THE KNOXVILLE, TENNESSEE MARKET

A Thesis

Presented to

the Graduate Council of

The University of Tennessee

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

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by

Dormal Newberry

June 1964

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CHAPTER I

INTRODUCTION

The marketing of milk presents problems that are very complex, The nature of the product, the many uses that can be made of it, the type of market channels through which it moves, and the importance placed upon it as a necessary food have led to a great deal of controversy in the public mind and in the market place. These conditions have led to substantial regulation, both health and price, in the market milk industry. There are varying opinions as to the amount of regulation necessary. These range from a minimum of regulation to that of a public utility. Regardless of the merits, regulation does exist.

The most widespread form of regulation of milk marketing occurs under the federal milk order program. The conditions leading to the establishment of federal milk marketing orders were many and varied. During the early 1900's, milk was purchased from the producer by the handler at a flat price per hundredweight. Due to the fluctuating supply and demand, there were seasons of the year when the supply of milk did not meet the demand and other times when the supply far exceeded the demand. Also, there were day-to-day fluctuations in supply and demand that created further difficulties. With these prevailing conditions, producers did not have much assurance of a stable market for their milk. So, marketing cooperatives sprang up and the marketing picture began to change. The pricing system was

changed. Instead of the flat price, the classified pricing system which paid producers according to use made of their milk was adopted and spread to several markets.[1] The highest value use was for fluid milk products. Milk not used for fluid consumption went into manufactured products and was paid for at a lower rate. Milk for fluid use was classified usually as Class I milk while milk going to butter, cheese, canned milk and other manufactured products was termed Class II. Today, classified pricing is used in all major markets of this country.

Classified pricing alone did not solve all of the major problems of milk marketing. Cooperatives had to devise some method for equitable distribution of returns from the sale of milk to their producers. As matters stood, a handler with a high Class I utilization would pay his producers much more for milk than a handler with a low percentage Class I utilization. This resulted in much disruption in the market scheme. Producers selling milk to the low percentage Class I utilization handler wanted to transfer to the handler with the higher Class I utilization.

These conditions led to the development of what is known as "market pool" and "market blend price." This is a device whereby all handlers on a given market pay the same price for their milk according to the use made of it in the entire market, and all producers supplying the market receive the same price for all the milk they sell

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[1] E. W. Gaumnitz and O. M. Reed, Some Problems Involved in Establishing Milk Prices, Agriculture Adjustment Administration, United States Department of Agriculture (Washington: Government Printing Office, September 1937), p. 31.

during any given pay period. Individual handler pools are still used on some markets, yet in 1962 seventy of the eighty-three federal order markets used the market wide pool.[2]

Other weaknesses became apparent in this scheme. For example, a handler could gain a competitive advantage by incorrectly reporting his classification use. Cooperatives tried to guard against this by hiring accountants to audit handler records. This met with limited success.

During the widespread depression of the early 1930's producer milk prices declined sharply in all markets, including city markets served by strong producer cooperatives. The prices for manufactured dairy products declined sharply and as a result, producers of manufactured grade milk exerted great pressure to sell at least a portion of their production in the fluid markets. The handlers and their union employees were able to maintain their margins and wage rates fairly well with the result that the major portion of the price decline had to be borne by the producers in the form of sharply lowered milk prices. The fluid milk market became disorganized and chaotic, with the result that producer groups sought some form of governmental regulation.

Congress sought to relieve these chaotic conditions for farm commodities by passing the Agricultural Adjustment Act of 1933. One part of this law gave the Secretary of Agriculture authority to regulate the

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[2]United States Department of Agriculture, Federal Milk Order Market Statistics, Statistical Bulletin 335 (Washington: Government Printing Office, August 1963), p. 12

marketing of milk in such a way as to stabilize the market and increase returns to producers.

The production control features of the Agricultural Adjustment Act were declared unconstitutional by the Supreme Court in January 1936. They also ruled against processing taxes on the ground that they were an inseparable feature of the production control plans.[3] The Agricultural Marketing Agreements Act was enacted in 1937 and provides the legal basis of federal milk marketing orders of today.

The federal order program incorporated many of the features that had been developed by the dairy industry. The classified pricing policy and the blend price technique were maintained. The orders fixed minimum prices to be paid to producers for milk classified according to use. These prices were set at a level which would insure a sufficient supply of milk to meet the Class I demand of the market. Since milk for fluid consumption commanded a higher price than milk for manufactured uses, the price for Class I milk was determined by the price of milk of manufacturing grade plus some specified differential.

Through experience in operating these federal order markets, it was found that as market conditions changed, there arose a need to change the level of the Class I price. So, to avoid the expense of amending the order to change the Class I price every time the supply-demand relationship deviated from the usual supply-demand relationship, the supply-demand price adjuster was incorporated

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[3]U. S. Department of Agriculture, Price Programs, Agricultural Information Bulletin No. 135 (Washington: Government Printing Office, 1957), p. 55.

into many orders. In December 1962, fifty-seven federal orders contained Class I supply-demand price adjusters.[4]

Federal milk marketing orders play an important role in milk marketing today. This is borne out by the fact that approximately 187,000 farmers delivered 51.6 billion pounds of milk to handlers regulated by eighty-three federal milk marketing orders during the year of 1962.[5] These marketing areas contained about 59.8 percent of the non-farm population.

Importance of the Study

There has been much discussion about how much "operating reserve" supply of milk is needed to meet the Class I demand of a market.[6]

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[4]United States Department of Agriculture, Federal Milk Order Market Statistics, Statistical Bulletin 335 (Washington: Government Printing Office, August 1963), p. 20.

[5]United States Department of Agriculture, The Federal Milk Marketing Order Program, Marketing Bulletin 27 (Washington: Government Printing Office, July 1963), p. 2.

[6]A distinction is made in the kinds of reserve or surplus milk. There is operating reserve, which is that extra supply necessary to meet the needs caused by fluctuation in day-to-day Class I sales and day-to-day production. Seasonal reserve is that milk in excess of day-to-day Class I sales and operating reserve that is necessary due to the seasonality of supply and demand. Surplus is that portion in excess of day-to-day Class I sales, operating reserve and seasonal reserve. These definitions will apply throughout this report.
Alexander Swantz, The Marketing and Pricing Structure for Bulk Sweet Cream In Kansas, Missouri and Oklahoma Markets, United States Department of Agriculture, Marketing Research Report No. 74 (Washington: Government Printing Office, November 1954), p. 5.

Determining the amount of necessary reserve must take account of the following: (1) seasonality of supply, (2) day-to-day variations in supply, (3) seasonality of demand, and (4) day-to-day variations in demand.

It has generally been assumed and accepted throughout the dairy industry that a supply of 110 percent of the Class I demand is sufficient. Is this 110 percent on a daily, weekly, monthly or yearly basis? There appears to be disagreement in this respect. Research on the amount of milk necessary to carry the Class I demand of a market is limited.

Many federal orders contain supply-demand price adjusters. These were incorporated into the orders on the basis of the normal surpluses for each individual market rather than the amount of operating reserve necessary to meet the Class I demand. It is difficult to plan the proper procurement program without information on the necessary supply, thus knowledge of this reserve would help in operations of the federal milk order program. In addition, there has been considerable interest in Congress in 1962-64 for enabling legislation to establish quotas to producers in federal order milk markets. If this proposed legislation is realized, there must be some basis for determining the necessary supply for a given market so that a reasonable relationship will exist between assigned quotas and the Class I demand (including operating reserve).

Objectives of the Study

This study will attempt: (1) to analyze present methods of computing operating reserve on the Knoxville, Tennessee, market and

therby provide a basis for setting optimum ranges in supply-demand adjusters, (2) to help handlers and producers (or their cooperatives) in determining what is an adequate supply of fluid milk for this market, (3) to provide an empirical basis for delineating limits to supply needs for the market which would be useful if voluntary quota plans are instituted. While all of these objectives refer to the Knoxville market they may have application to other federal order markets.

Procedure

In order to determine sufficient supply, a study was made of selected milk handlers on the Knoxville, Tennessee, market. Handlers representing a major share of the market were selected. Periods of time were selected for collecting sample data in such a way that each season of the year would be analyzed. Four such sample periods were delimited.

The data consisted of the raw milk inventories on a daily basis for each period, the receipts of producer milk by days for each sample period, the amount of milk processed per day for each sample period and the amount of packaged fluid milk disposed of per day for each sample period.

The inventories, receipts, processing and disposition were obtained so that comparisons could be made of each. The deliveries of milk to the total market were obtained so that it would be possible to determine if sampled handlers received intra- and inter-market

transfers of milk in addition to their normal day-to-day receipts from the cooperative.

Seasonal supply and demand indexes were determined so that the seasonal reserve could be ascertained for the months in which the optimum reserve was not obtainable. The problem was to determine what constituted a sufficient supply of milk to meet the Class I demand on the Knoxville, Tennessee, market.

Hypothesis

It was hypothesized that a more realistic and accurate estimate of operating reserve could be obtained than the currently and frequently used estimate based largely on tradition. Such an estimate should be based on empirical data from day-to-day records. While these data are not easily obtainable, in this case they were available through the cooperation of the leading handlers on the market.

Review of Literature

There have been several studies conducted on the various factors that affect the supply and demand for milk. One such factor is the price elasticity of demand for milk. There is considerable research available on the elasticity of demand for fluid milk.[7]

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[7]For a report on these studies see: Anthony S. Rojko, The Demand and Price Structure for Dairy Products, United States Department of Agriculture, Technical Bulletin No. 1168 (Washington: Government Printing Office, May 1957), p. 105; and G. E. Brandow, Interrelations Among Demands for Farm Products and Implications for Control of Market Supply, The Pennsylvania State University Agricultural Experiment Station, Bulletin 680 (August 1961).

Research as to the effects of price upon the supply of milk is not so prevalent. However, one of the most recent reports in this area shows the price elasticity of supply for the short-run to range from 0.15 to 0.30 and the long-run from 0.35 to 0.50.[8] This would indicate that producers are not very responsive to price change in the short-run but more so in the long-run. However, in both cases this shows production to be more responsive to price than indicated in earlier studies.

Much has been said about supply-demand price adjusters and a sufficient supply of milk. However, a recent study of supply-demand price adjusters in a number of Mid-western markets indicates that the relationship between Class I utilization and supply is based upon the past or existing ratio for the market.[9] Only when the Class I utilization and supply ratio deviates from this norm is the Class I price adjusted.

The supply-demand price adjuster was incorporated in the Knoxville Federal Milk Order June 1, 1951. This provision provided for a price decrease of 2.5 cents per hundredweight for each percentage point that the supply was above 110 percent of demand. There was no provision for raising the price if the supply in relation to the demand was less than 110 percent. A 12-month moving average was used to compute the supply-demand ratio. The order was again amended

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[8]Harlow W. Halvorson, "The Response of Milk Production to Price," Journal of Farm Economics, Volume XL, No. 5 (December 1958), p. 1111.

[9]The Mechanics of Supply-Demand Adjusters for Midwestern Milk Markets, North Central Regional Publication 134, University of Illinois Agricultural Experiment Station Bulletin 684, (Urbana: April 1962), p. 10.

December 1, 1954, which changed the mechanics of the supply-demand price adjuster. The 12-month moving average was changed to the most current previous two months as the base period. This amendment also took into consideration the seasonality of supply and demand. The months of November and December had a norm of 110 percent of supply over demand. These were considered to be the months that the differences between supply and demand were minimal. The supply-demand base was set at over 110 percent for the remaining months of the year.

The Knoxville Federal Milk Order has been amended since 1954, but the supply-demand adjuster has not been materially changed. The 110 percent base still remains for the months of short supply. From this, it can readily be seen that the pricing of Class I milk has been on the basis that it is necessary to have a supply of 110 percent of demand even though limited research has been done to establish the amount of reserve needed. The situation which exists in Knoxville may also exist in other orders where the supply-demand adjuster has been used.

The literature on quotas is voluminous, especially since the proposed Food and Agricultural Act of 1962. Several bills were introduced in Congress in 1962 and in 1963 that would have provided enabling legislation for Class I quotas in federal order markets.

Implications of the Results

The implications of this study fall within the following categories: (1) procurement, (2) economic alternatives, and (3) institutional.

If it can be determined what constitutes a sufficient supply of milk for the Class I demand, this can be used as a guide for future procurement. Handlers or cooperatives with the responsibility for the supply can use this estimate in directing their efforts.

As a result of this study, handlers may be able to alter their processing pattern. This could possibly be accomplished in the short-run by changing processing days and most definitely in the long-run where even plant processing facilities could be changed. This could alter the plants' cost structure. If the processing pattern was altered, the receipts pattern could also be changed which could affect the hauling cost structure. There appears little likelihood that the Class I demand pattern could be changed, particularly in the short-run.

If Class I quotas are adopted in federal order milk markets, there must be some indicator as to the needs for Class I use in setting the market quotas. This study could be used in this respect. Also, it could be used in making future changes in the supply-demand price adjusters in federal order markets.

CHAPTER II

SELECTION OF THE SAMPLE AND LIMITATION OF THE RESULTS

Structure of the Market

The structure of the Knoxville market is similar to most milk markets in the United States. It is supplied by many small producers selling to a few handlers. The composition of the producers has undergone considerable change in recent years. The market is being supplied by fewer and larger producers with a fairly constant increase in supply.

In December 1963, there were 754 producers of various sizes supplying the market.[1] These were all located within a radius of approximately 80 miles of Knoxville (see Figure 1), with 99.3 percent of all the producers shipping milk in bulk tanks. The producers have a marketing cooperative with the membership consisting of approximately 88 percent of all the producers shipping milk to handlers regulated by the Knoxville Federal Order. The Knoxville Milk Producers' Association provides marketing services for its members, such as bargaining for price, handling surplus and seasonal reserves of milk that local handlers do not require and various other services connected with the marketing of grade A fluid milk.

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[1] Milk Market Information, Knoxville, Tennessee Marketing Area, USDA-AMS, Federal Order No. 101, Vol. 15, No. 6 (Knoxville, Tennessee: January 1964), p.6.

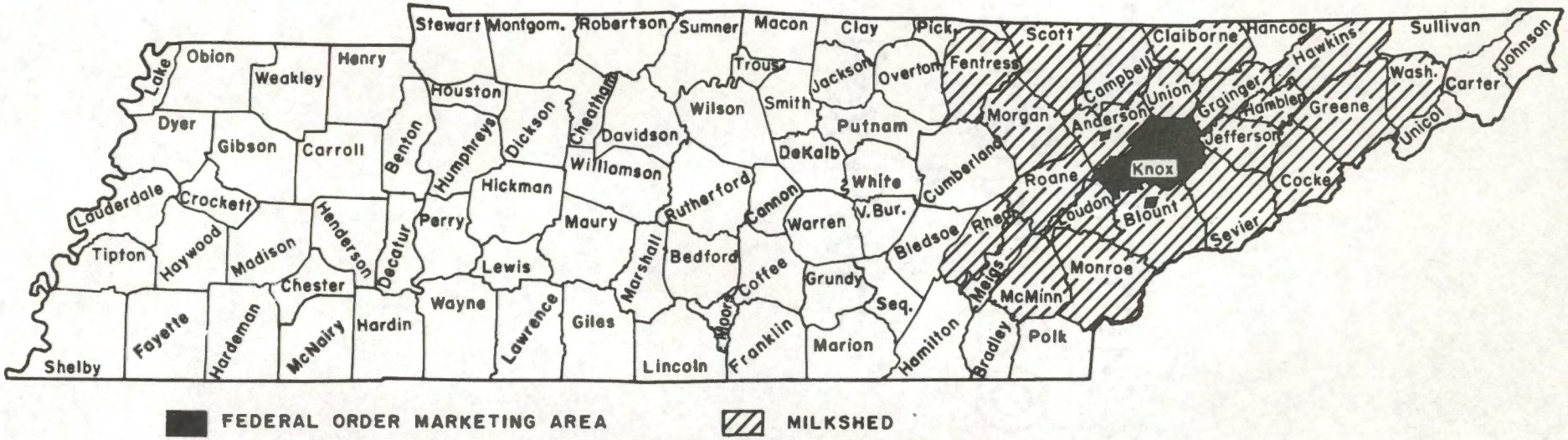

Figure 1. Knoxville federal milk order marketing area and milkshed, December, 1963.

The cooperative has complete control over the hauling of the milk from the farm to the processing plant with the exception of one handler. This was accomplished through the purchase of the transport tanks which were then leased to contract haulers. Thus, it appears that the cooperative serving the Knoxville market has obtained substantial power in the market place. Nevertheless, the cooperative must be competitive with other sources of milk supply because it is not in a position to exert much control over these alternative sources, which are substantial to the North and East of the Knoxville market.

The ten Knoxville handlers range in size from the relatively small independent to the large national firms represented by Sealtest Foods (National Dairies) and Pet Milk Company. The operation of these handlers vary from the straight Class I operator (handling only fluid milk products) with only limited operating reserve to the multiple operators consisting of Class I and manufactured products such as cottage cheese and ice cream.

Prior to April 1963, each handler disposed of its own surplus milk. This included surplus used in their own plants to manufacture cottage cheese and ice cream and that moved off the market in the form of whole milk to condenseries, cheese plants and powder plants. During April 1963, the cooperative assumed the responsibility of providing the necessary supply of milk for the handlers and disposing of all surplus milk for those requesting this service.

A distinction is made between the distribution area and the marketing area as defined by the Knoxville Federal Milk Order (see

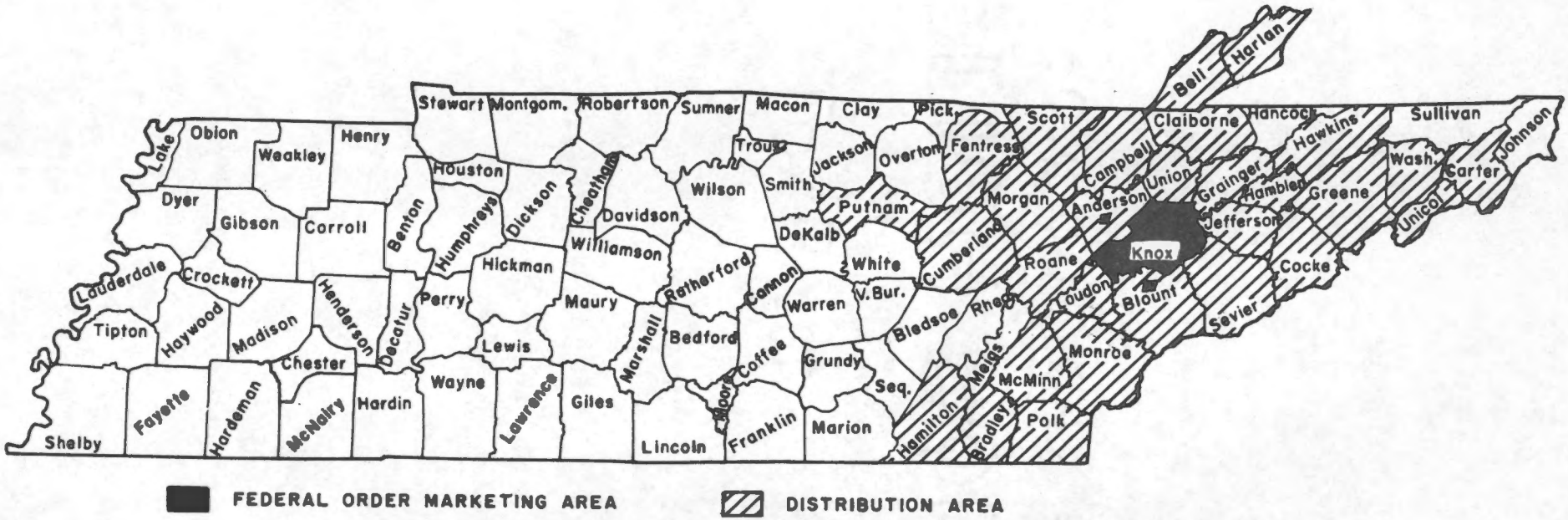

Figure 2. Knoxville federal milk order marketing area and distribution area, December, 1963.

Figure 2). The concentration of sales is in the areas of Knoxville, Oak Ridge, Morristown and Maryville-Alcoa.

There appears to be substantial market power from both the producers' and handlers' positions, and there is also much competition. This competition not only comes from within the Knoxville market but from outlying markets as well.

The market structure is considered on two levels. First, there is the concept of many producers selling to a few handlers which results in an oligopsony. This situation has been modified by the cooperative which acts as one seller for the many producers. A situation in which one seller (the cooperative) faces a few buyers is called a monopolistic oligopsony.[2]

Second, there is the situation of the handler and his disposition. At the retail level, there are a few handlers selling to many consumers on the home delivery routes, which results in pure oligopoly. This is modified somewhat with a few handlers selling to a few large retail marketing firms at the wholesale level. This situation results in a bilateral oligopoly.[3]

Market structure is important in determining the necessary supply of milk for the market. If there is one agency responsible for the supply of milk then this agency can direct the shipments of milk to the handlers who need it. The market reserve would probably be

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[2]William H. Nicholls, A Theoretical Analysis of Imperfect Competition with Special Application to the Agricultural Industries (Ames: The Iowa State Press, 1941), p. 14.

[3]Ibid.

somewhat different if each handler were responsible for his own procurement of supply.

Criteria Used in the Selection of the Sample

For a study of this nature, the ideal situation would be to use complete records of supply, processing and disposition for all handlers on a daily basis over several years. This was not practical since only a few handlers kept detailed daily records and time limited the number of periods that could be sampled. The second alternative then was to select as many handlers as possible with detailed daily records and to select periods of time to use for collection of sample data.

Selection of handlers. The principal criterion used in the selection of these handlers was the availability and accuracy of their daily records. Other items of comparison between handlers were:

1. Size of the handlers.
2. Relationship of wholesale and retail distribution.
3. The number of days of the week that milk was received, processed and distributed.
4. The amount of raw milk storage capacity available in handlers' plants.
5. The total operation of the handler: i.e., whether the handler was a straight Class I operator or Class I and manufacturer of by-products.

First and foremost in any study is the accuracy of the data to be analyzed. The handlers selected maintained records that contained the

type of information desired for this study. This is not to infer that other handlers did not keep adequate and accurate records, but for this study the handlers selected had far superior records.

The handlers were grouped according to size. The groupings were small, medium and large. Those with less than one million pounds of Class I milk disposition per month were classed as small handlers; those with between one and two million pounds of Class I milk disposition per month were classed as medium-size handlers; and those with two million pounds and over of Class I disposition per month were classed as large handlers. On the basis of 1963 Class I disposition there were two large handlers, six medium handlers, and two small handlers on the Knoxville market (Appendix Table IX). Two handlers were selected from the large-size category and one from the medium-size for purposes of this analysis. None were selected from the small-size category because of the inadequacy of their records for the type of data desired for this study.

The type of distribution was considered to be important in the selection of the sample handlers. All handlers on the market had retail and wholesale distribution—some also sold to independent distributors.[4] The handlers selected consisted of one with retail and wholesale distribution and two with retail, wholesale and distributor sales.

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[4]Retail distribution was that which was delivered to the home by the handler; distributor sales was that which was sold to a person at the handlers dock for resale or moved from the handler's plant to a distribution station, and wholesale distribution was every type that was not included in retail distribution or distributor sales. This included sales to super markets, restaurants, schools, etc.

Since the number of days of the week that distribution was made would affect the amount of operating reserve necessary, the sample handlers chosen had to be representative in this respect or the results would be greatly distorted. The Class I weekly product distribution pattern for all the handlers serving the market was quite similar with all distributing the major portion of their milk on Monday-Saturday.

The number of days of the week that milk was received would also affect the receipts pattern of the market. All handlers serving the market with the exception of one small- and one medium-size handler received producer milk every day. All the selected handlers received producer milk daily.

The processing pattern was dependent upon the daily volume and number of days of the week that milk was processed. There were four handlers that processed milk six days each week. The remaining ones were processing on a five-day-a-week basis. Of the four that processed six days a week, one fell in the large-size category, two in the medium range and one in the small size. The reasons that these four processed six days a week were the lack of adequate storage room for the packaged products and the limited processing equipment. The selected handlers consisted of one that processed six days a week and two that processed five days a week.

The Knoxville market appears to have sufficient raw milk storage for a five or six-day processing schedule. Storage capacity is important in determining the amount of operating reserve necessary for any market. If the market does not have adequate raw milk storage space, then a

larger operating reserve would be necessary. Every handler on the Knoxville market had adequate raw product storage space for their daily operations. Most of the handlers had raw product storage capacity for a minimum of two days processing. Each of the handlers selected for the sample had storage capacity for the equivalent of two days of processing—a combined total of 55,000 gallons.

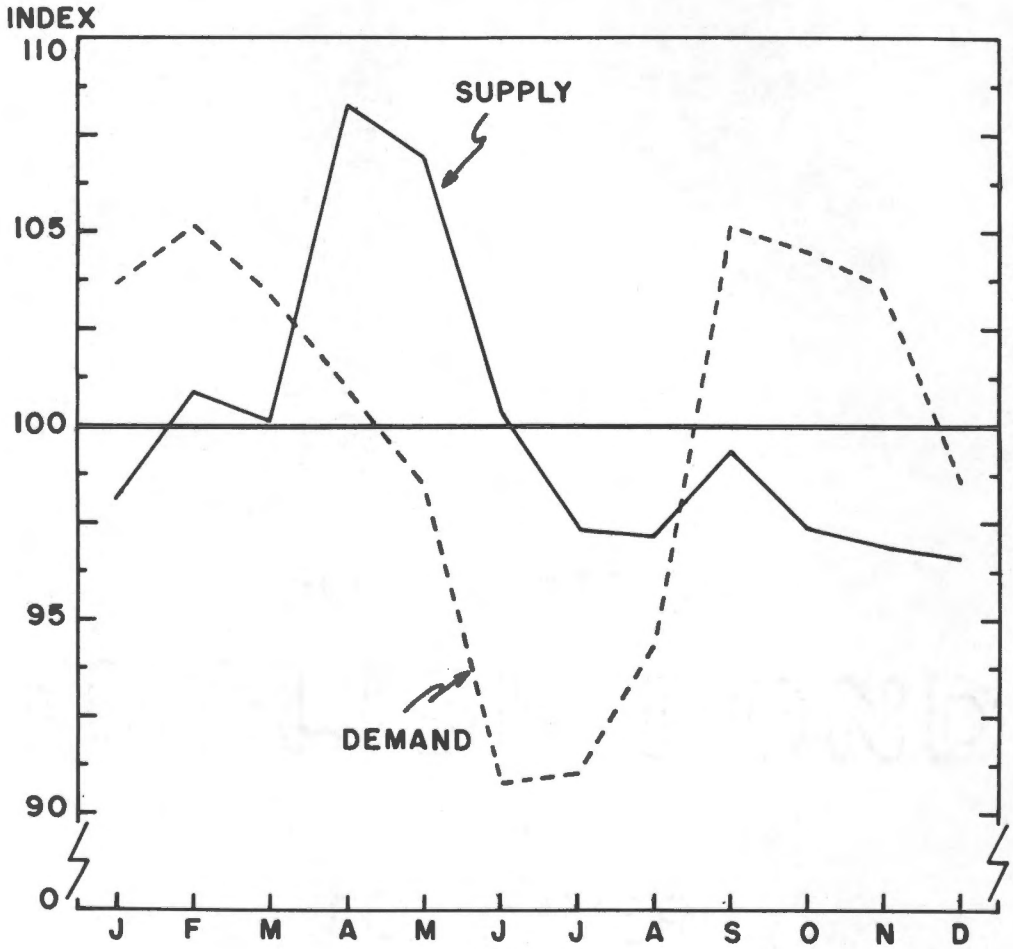
Of the three handlers selected for the sample, one handled fluid products only and the other two manufactured cottage cheese in addition to the fluid products. The sample handlers represented slightly more than 50 percent of the total Class I volume of the market.

Selection of study periods. The time period under study consisted of December 1962 through November 1963. Four one-week periods were selected for the study. Each season of the year was represented by one sample period, as nearly typical as possible. The supply and demand indexes were calculated for use as a guide in the selection of each sample period (Figure 3). Weeks containing holidays were eliminated. Each period selected during the school term consisted of days when schools were not dismissed for any reason.

All sample periods were examined to determine if any abnormalities could be detected in Class I disposition. There was no apparent disparity from the expected pattern of disposition in the sample periods selected.

The months were then grouped for analysis as follows:

Time Period			
1	2	3	4
December	March	June	September
January	April	July	October
February	May	August	November



SUPPLY [a]	98.19	100.99	100.19	108.20	106.90	100.29	97.39	97.29	99.49	97.49	96.99	96.59
DEMAND [a]	103.71	105.14	103.38	100.92	98.58	90.79	91.08	94.38	105.26	104.61	103.61	98.54

[a]Data from a 12-month centered moving average for January 1960 through December 1963. (Source: Milk Market Information, Knoxville, Tennessee Marketing Area, USDA-AMS, Federal Order No. 101 (Knoxville, Tennessee: January 1960 through December 1963).

Figure 3. The relationship of seasonal supply and demand indexes for the Knoxville market.

The following sample periods were selected:

Period 1. January 6 - 12

Period 2. April 21 - 27

Period 3. June 16 - 22

Period 4. October 6 - 12

The sample data were collected from the handlers' daily records of inventories, receipts, processing and distribution so that a reconciliation of receipts, processing and sales could be made. The receipts, processing and Class I distribution patterns were developed and comparisons made of each.

Assumptions Concerning the Results

For any study of this nature, certain assumptions must be made, some implicit and some explicit. The assumptions under which this study was conducted were as follows:

Explicit assumptions.

1. The seasonal demand patterns for the sample periods were not different from the normal pattern. The solution to the whole problem revolved around the demand pattern.
2. The seasonal demand pattern would remain static, but the processing and receipts patterns could be altered by the handlers. In the short-run this could be accomplished by adjusting days of receipts and processing and utilizing market wide holding capacity; in the long-run new facilities for processing and new holding capacity could be constructed.

3. The sample handlers were similar to other handlers on the market. Actually they were somewhat larger but had similar processing, receipts and sales patterns (see Appendix Table IX).
4. The sample periods were representative of the other weeks in the months included in each sample period.
5. Producers are fixed on the market; i.e., supply is adjusted through price changes or other economic factors and not by dropping or adding producers seasonally.
6. The butterfat test of the supply and disposition were constant for each sample handler and each sample period. The butterfat tests for receipts and disposition were available for the month but not for the individual days.
7. There was no material change in the opening and closing inventories for packaged products for each sample period.

Implicit assumptions.

1. Assumes no producer or retail price changes which would affect sales or milk procurement during the sample periods.
2. No change in holding capacity of the market during 1963.
3. No change in 1963 from other years with the introduction of a full supply contract with the cooperative.
4. No seasonal changes in utilization of milk and milk products in 1963 from the normal or historical use.

CHAPTER III

DETERMINATION OF THE SAMPLE PATTERNS

This chapter is devoted to that portion of the problem dealing with the sample pattern of receipts, processing and Class I disposition. The purposes of this phase of the investigation were to establish the receipts, processing and Class I disposition patterns so that the effects of these patterns upon the reserve necessary for operations could be determined.

Receipts

The receipts data were obtained from two sources: the Knoxville Milk Producer's Association which represents approximately 88 percent of the total deliveries for the market and the sample handlers. The purposes of the milk delivery data from the Knoxville Milk Producer's Association were: (1) to establish the receipts pattern for the entire market; (2) to distinguish any differences that might exist between the market and the sample handlers; and (3) to determine, if possible, any producer milk that the sample handlers might have received in addition to their normal supply.

The total deliveries by the cooperative are presented in Figure 4 and Appendix Table III. The data were plotted in Figure 4 for all sample periods. There appears to be no definite pattern established between sample periods. Period I shows the deliveries to be considerably lower on Sunday than for the remaining days of the week. However, during

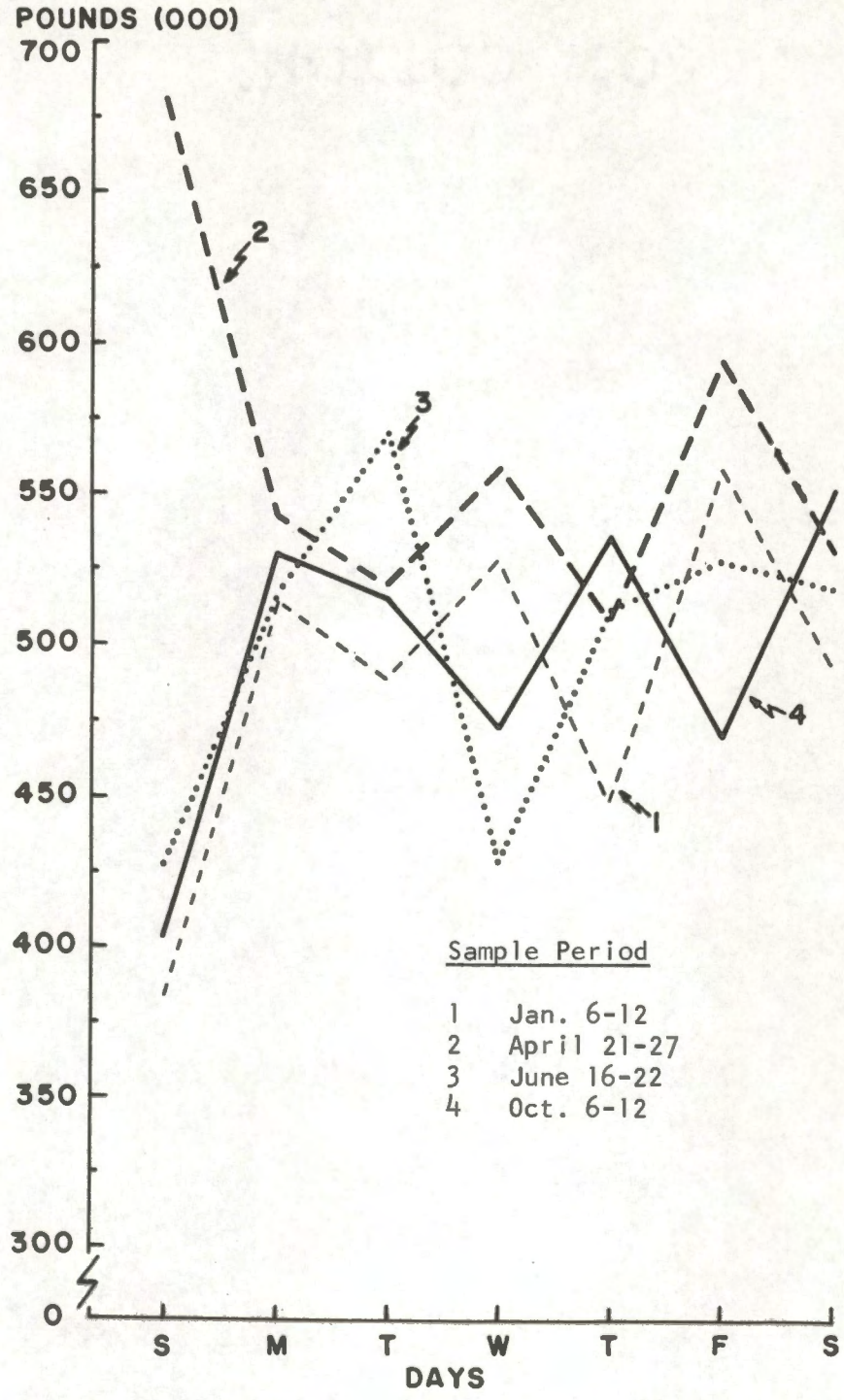


Figure 4. Milk deliveries by cooperative members for the total Knoxville market, 1963.

the remainder of the week plants were on an every-other-day schedule. For Period 2, Sunday deliveries were high compared to the remaining days of the week. It appears that the reason the deliveries were high on Sunday during Period 2 was that this was the season of flush production (April) and the market customarily transfers large quantities of surplus milk to manufacturing plants on the week ends.

For Periods 3 and 4, Sunday deliveries were low compared to the remaining days of the week, with no every-other-day delivery pattern consistently evident.

It could not be determined whether the sample handlers received milk from the cooperative in excess of their normal supply due to the cooperative shifting loads of milk to various handlers and manufacturing plants. The cooperative has several tanks of milk that are not permanently assigned to any handler and these were shifted to various handlers during the sample periods.

The receipts of producer milk by the sample handlers represents all milk the sample handlers received from producers regulated by the Knoxville Federal Order. These receipts are presented in Appendix Table IV. This table shows receipts of milk by days for each sample period and the mean for the entire sample. Also, the daily percent of the total receipts for each sample period is shown.

The receipts are low for each sample period on Sundays with these receipts representing from 6.6 percent of the total for Period 4 to 10.7 percent for Period 2. The receipts on Wednesdays represent 9.9 percent of the total for Period 1 and 16.1 percent for Period 4. There appears

to be no definite established receipts pattern between sample periods by the sample handlers (Figure 5). There is a tendency for the receipts to be rather low on Sundays and Wednesdays as compared to the total daily average. Handlers apparently only receive milk from the producers to meet immediate needs.

Processing

The processing data were obtained from the packaged finished product for one sample handler and from the volume of milk to be processed for the two remaining sample handlers. This was taken into consideration in the aggregation of the processing data.

There was no milk processed on Sundays and very little on Wednesdays (Appendix Table V). The maximum processing days were Monday, Tuesday, Thursday, and Friday with Saturday falling slightly below these days. There was a definite pattern established for processing by the sample handlers (Figure 6).

Class I Disposition

For the purpose of this study, Class I disposition was considered to have been made on the day that the sample handler recorded the transaction. In the case of distributor sales, the handler recorded the sale as of the date the distributor obtained the milk at the handler's plant, although the distributor may not have disposed of it until a day or two later. There are some slight discrepancies in the wholesale and retail sales due to the handlers accounting methods. Two of the sample handlers inventoried delivery trucks only once a week and there is some disparity

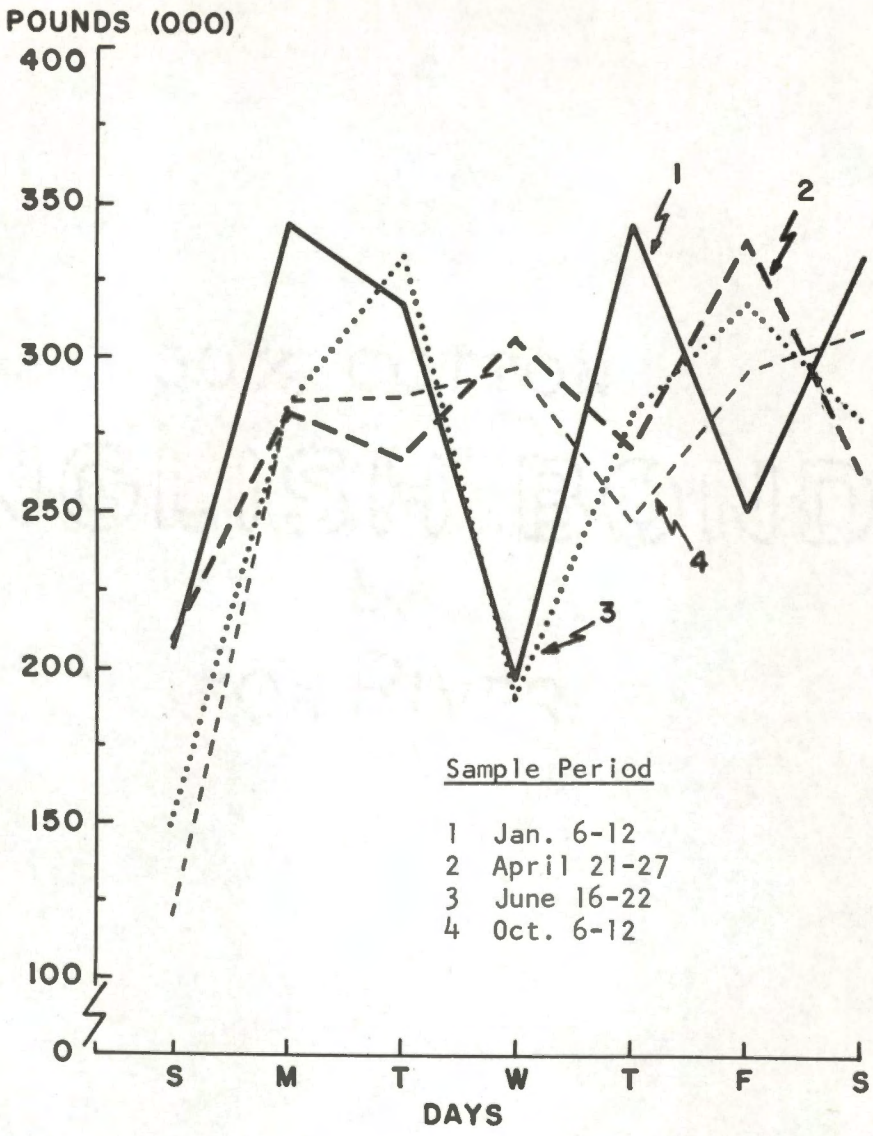


Figure 5. Receipts of producer milk by days during each sample period, Knoxville, 1963.

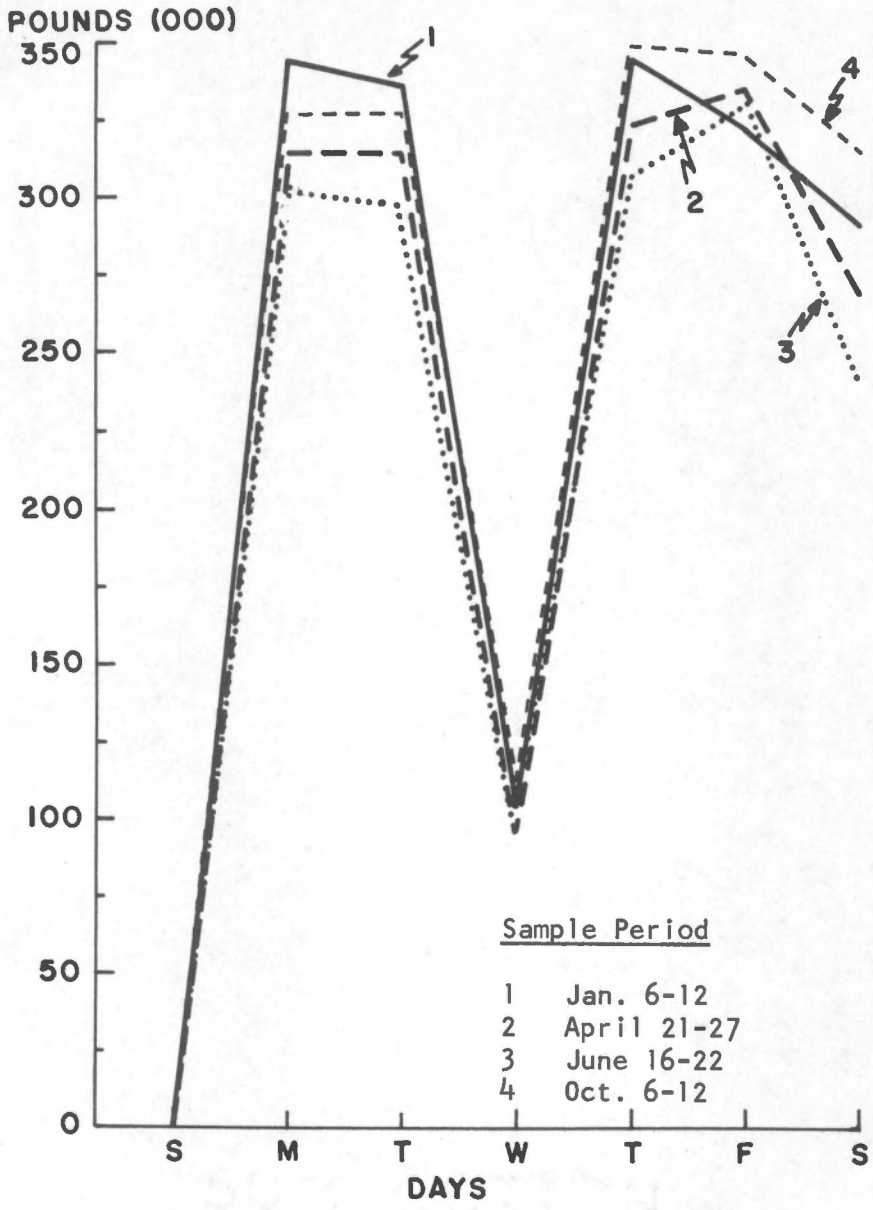


Figure 6. Milk processed by days for each sample period, Knoxville, 1963.

in the Class I disposition on this day in relationship to the remaining days of the week. These discrepancies were minimal and do not detract from the results obtained.

The Class I disposition data are presented in Appendix Table VII. This table includes the pounds of milk disposed of by days, the total pounds by sample periods, the daily percent of the total and the mean for the entire sample. There was very little Class I milk disposed of on Sundays, only about one-half of one percent, which was sold to distributors to be distributed later. Of the remaining days, Wednesday was the lowest in sales, representing from 13.0 percent of the total sales for Period 1 to 14.9 percent for Period 4. Sales on Tuesdays and Thursdays were about equal. Mondays, Fridays and Saturdays were the highest disposition days, with Friday being the peak day. All sample periods fell within the same pattern with some leveling out on Tuesday, Wednesday and Thursday for the 4th sample period (Figure 7).

A comparison was made of the receipts, processing and Class I disposition patterns (Figure 8). There was no receipts pattern established between sample periods for either the total receipts from the Knoxville Milk Producer's Association or the sample handlers, but there was a very definite pattern of both processing and Class I disposition between the sample periods.

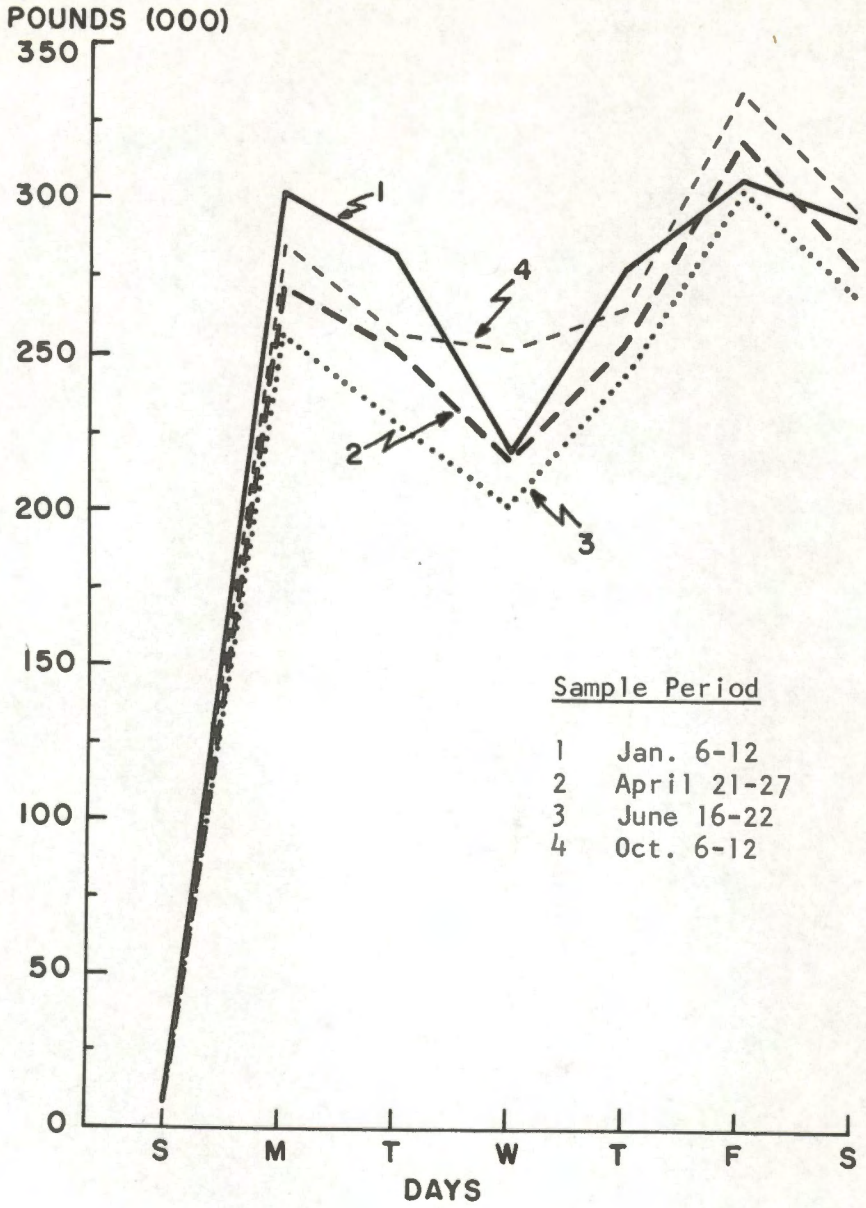


Figure 7. Class I disposition by days for each sample period, Knoxville, 1963.

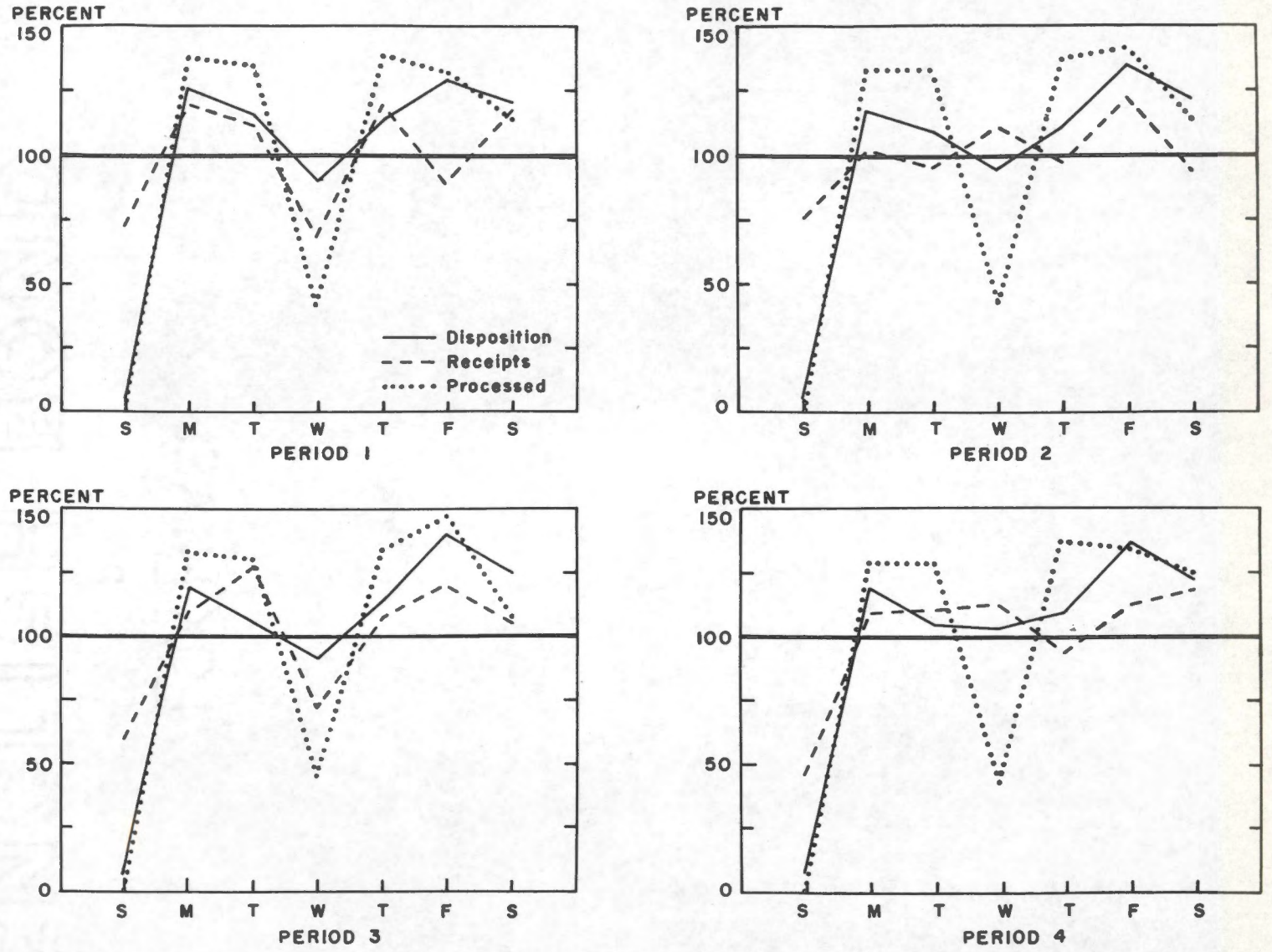


Figure 8. Comparison of receipts, processing and Class I disposition by days for each sample period, Knoxville, 1963.

CHAPTER IV

DETERMINATION OF THE OPERATING RESERVE AND THE PROJECTION OF THE SUPPLY

This chapter is devoted to the reconciliation of receipts, processing and Class I disposition of the sample handlers for each sample period and the projection of the supply in relation to the demand based upon the obtained operating reserve and the supply and demand indexes.

Reconciliation of Receipts and Utilization

The receipts consist of producer milk only unless additional milk was needed in the processing. No consideration was given to the shrinkage incurred from the pick-up of the milk at the farm to delivery at the handler's plant. For this study, it was assumed that there was no shrinkage.

The butterfat tests of the daily receipts were not available, so the average tests of producer receipts for the month were used for each individual handler in the sample. These tests were used in calculating the whole milk equivalent of the milk processed (Appendix Table VI).

The inventories consisted of bulk raw milk, skim and cream. These inventories were obtained from the individual handlers in the sample and combined for reconciliation purposes.

The reconciliation of pounds of milk product received and pounds processed is presented for each sample period in Table I. The "supply used" line was obtained by adding the opening inventory and

TABLE I

RECONCILIATION OF MILK PRODUCT POUNDS RECEIVED AND PROCESSED

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Period 1				January			
	6	7	8	9	10	11	12
Opening inventory	78,733	285,422	223,218	171,250	259,176	225,345	134,315
Received	206,689	343,279	318,138	196,921	342,037	253,873	336,006
Closing inventory	285,422	223,218	171,250	259,176	225,345	134,315	166,840
Supply used[a]	0	405,483	370,106	108,995	375,868	344,903	303,481
Period 2				April			
	21	22	23	24	25	26	27
Opening inventory	120,719	327,764	252,515	124,589	314,116	219,707	157,156
Received	207,045	282,682	268,460	307,450	271,331	340,215	264,364
Closing inventory	327,764	252,515	124,589	314,116	219,707	157,156	91,553
Supply used[a]	0	357,931	396,386	117,923	365,740	402,766	329,967
Period 3				June			
	16	17	18	19	20	21	22
Opening inventory	103,661	254,109	180,327	164,740	225,662	155,106	98,814
Received	150,448	284,674	334,281	192,449	283,975	317,034	280,707
Closing inventory	254,109	180,327	164,740	225,662	155,106	98,814	66,866
Supply used[a]	0	358,456	349,868	131,527	354,531	373,326	312,655
Period 4				October			
	6	7	8	9	10	11	12
Opening inventory	150,557	271,744	183,258	104,949	286,410	155,061	49,269
Received	121,187	284,807	288,802	296,975	248,271	296,168	310,551
Closing inventory	271,744	183,258	104,949	286,410	155,061	49,269	42,570
Supply used[a]	0	373,293	367,111	115,514	379,620	401,960	317,250

[a]Product pounds used in processing Class I products, Class II utilization on the market and transfers by handlers to manufacturing plants.

the amount received and subtracting the closing inventory. This line represents the maximum used for disposition, either by processing or bulk sales.

The "supply used" was transferred to Table II, which is the calculation of the amount of necessary reserve to meet the handler's processing demand. The "Class I disposition" line in Table II states the actual pounds of Class I milk disposed of by the sample handlers. The "processed" line states the actual pounds of milk processed. The "cream removed" line states the calculated amount of cream that was necessary to reduce the butterfat tests of the receipts used in processing to the butterfat tests of the aggregate finished products. To state it another way, the amount processed plus the cream removed represents the amount of whole milk necessary to obtain the processed pounds based upon the butterfat tests of the producer receipts and finished products. The "additional supply needed" line states the amount that the sum of the "processed" and "cream removed" exceeds the "supply used."

The figures in the "percent of Class I disposition" column were obtained by dividing the mean of the line represented by the mean of the "Class I disposition." The "supply necessary to meet the demand" was obtained by summing the percent of demand column or dividing the sum of the mean of the "processed," "cream removed" and "additional supply needed" by the mean of the "Class I disposition."

The amount processed compared to the Class I disposition varied between sample periods from 102.6 percent for Period 1 to 104.1 percent

TABLE II

THE NECESSARY SUPPLY TO MEET THE CLASS I DEMAND OF THE SAMPLE HANDLERS

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Mean	Percent of Class I Disposition
Period 1				January					
	6	7	8	9	10	11	12		
Class I disposition	8,794	304,492	282,959	221,093	278,032	308,332	295,197	242,700	--
Processed	0	344,073	336,544	104,426	344,207	321,701	292,874	249,118	102.6
Cream removed	0	9,824	9,266	3,174	9,949	8,190	8,083	6,926	2.9
Supply used[a]	0	405,483	370,106	108,995	375,868	344,903	303,481	272,691	--
Additional supply needed	0	0	0	0	0	0	0	0	0
Supply necessary to meet the demand	--	--	--	--	--	--	--	--	105.5
Period 2				April					
	21	22	23	24	25	26	27		
Class I disposition	8,744	269,729	251,004	219,699	254,756	321,870	278,334	229,162	--
Processed	0	313,963	315,485	94,595	323,911	334,378	268,883	235,888	102.9
Cream removed	0	7,546	6,084	6,076	9,200	6,767	3,580	5,607	2.4
Supply used[a]	0	357,931	396,386	117,923	365,740	402,766	329,967	281,530	--
Additional supply needed	0	0	0	0	0	0	0	0	0
Supply necessary to meet the demand	--	--	--	--	--	--	--	--	105.3

TABLE II (continued)

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Mean	Percent of Class I Disposition
Period 3				June					
	16	17	18	19	20	21	22		
Class I disposition	10,161	256,813	228,912	203,670	245,985	304,251	271,881	217,382	--
Processed	0	303,770	296,071	101,695	307,082	332,667	242,331	226,231	104.1
Cream removed	0	6,878	5,269	2,182	17,791	6,523	4,066	6,101	2.8
Supply used[a]	0	358,456	349,868	131,527	354,531	373,326	312,655	268,623	--
Additional supply needed	0	0	0	0	0	0	0	0	0
Supply necessary to meet the demand	--	--	--	--	--	--	--	--	106.9
Period 4				October					
	6	7	8	9	10	11	12		
Class I disposition	9,821	285,195	256,797	253,047	266,041	335,676	297,136	243,388	--
Processed	0	327,141	327,371	108,467	349,102	344,547	315,403	253,147	104.0
Cream removed	0	7,524	7,145	2,976	8,268	8,215	5,970	5,729	2.4
Supply used[a]	0	373,293	367,111	115,514	379,620	401,960	317,250	279,250	--
Additional supply needed	0	0	0	0	0	0	4,123	589	0.2
Supply necessary to meet the demand	--	--	--	--	--	--	--	--	106.6

[a]Product pounds used in processing Class I products, Class II utilization on the market and transfers by handlers to manufacturing plants.

for Period 3. There appears to be no ready explanation for these differences. The cream necessary to convert the processed milk to whole milk equivalent ranges from 2.4 percent for Periods 2 and 4 to 2.9 percent for Period 1. These variations are dependent upon two things: the butterfat test of the receipts and the butterfat test of the amount processed. The only additional supply necessary to meet the demand was in Period 4. This represented 0.2 percent of the Class I disposition.

The supply necessary including operating reserve, to meet the Class I demand varied from 105.3 percent of the Class I demand for Period 2 to 106.9 for Period 3.

Minimum Supply Estimate

According to the supply and demand indexes, if there is a sufficient operating reserve supply of milk during October, there will be an adequate supply the remainder of the year. By using October as the base month and the Class I disposition as a base of 100, the projected supply of producer milk was obtained (Figure 9). The operating reserve obtained in Period 4 was used as the base and through the use of ratios and the supply and demand indexes, the operating reserves for the remaining months were obtained. The projected supply in relation to the demand was compared to the actual supply and demand relationship for 1963. The main reason that the actual supply dropped below the projected supply was the extreme drought conditions during September, October, and November, 1963.

The classification of producer milk according to the definitions used in this report is presented in Figure 10. This shows how the

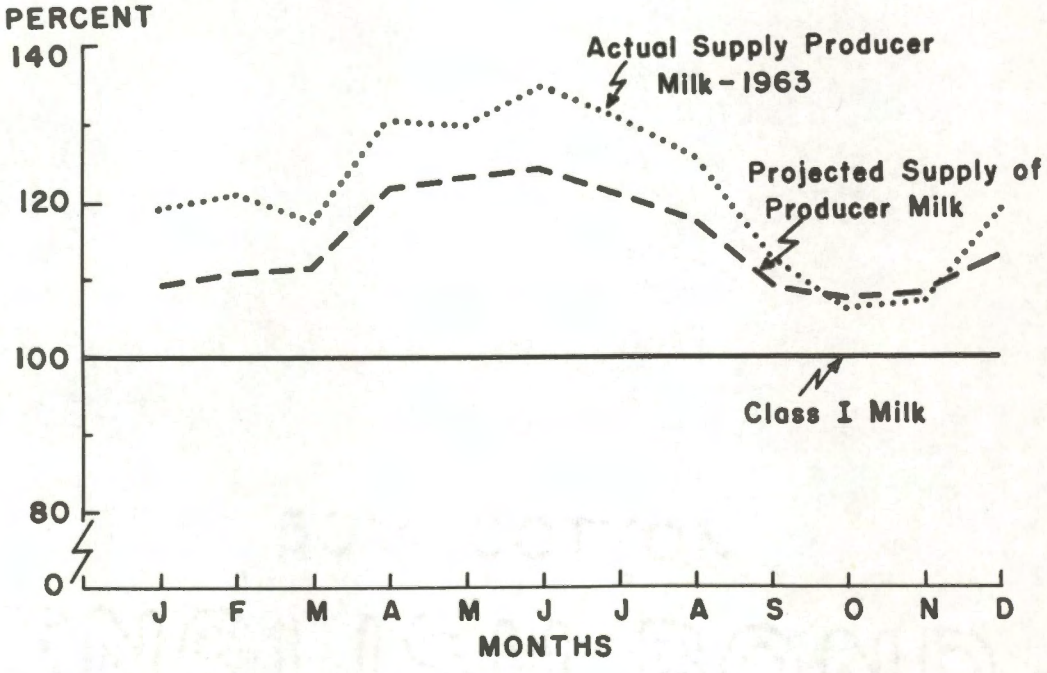
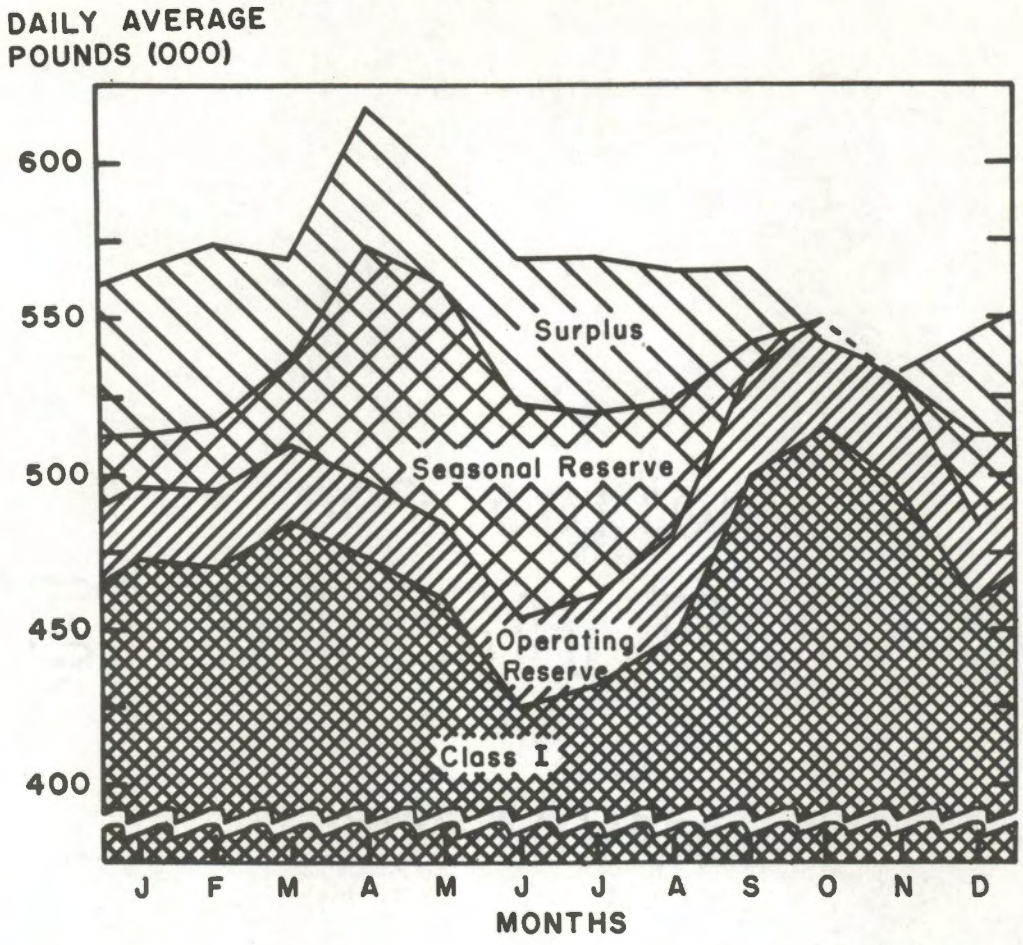


Figure 9. Total supply of producer milk for the Knoxville market during 1963 and projected supply in relation to the Class I demand.



Actual Class I Sales.

Operating reserve - computed at 107 percent of Class I sales.

Seasonal reserve - milk available all months, if minimum Class I sales plus operating reserve are met in October.

Surplus - milk received in all months over that needed for Class I sales, operating reserve and seasonal reserve.

Figure 10. Classification of producer milk on the Knoxville market during 1963.

market was supplied in relation to the Class I demand and the operating reserve. There was not an adequate operating reserve for October and November.

CHAPTER V

SUMMARY AND CONCLUSIONS

This study was made for the purpose of determining what constitutes an adequate supply of producer milk for the Knoxville, Tennessee, market. Such a measure might be used in setting the optimum ranges in supply demand price adjusters and as a guide for delineating limits to supply needs if a voluntary quota plan is instituted.

Operating reserve, seasonal reserve and surplus were defined so that the extra milk not used as Class I could be classified. The seasonal supply and demand indexes were calculated so that they could be used as a guide in classifying the excess milk and to project the optimum supply of milk in relation to the Class I demand.

One phase of the study was to establish the receipts, processing and Class I demand patterns. No definite receipts pattern was established for either the total deliveries for the market or the sample handlers, but there were very definite patterns established for the processing and Class I disposition between sample periods.

The raw whole milk storage capacity of the market was very important in determining the necessary operating reserve. This was true because of the tremendous fluctuations in day-to-day processing and Class I disposition. The necessary receipts for the Class I disposition and operating reserve varied from 105.3 to 106.9 percent of the Class I disposition. For a market with inadequate raw milk

storage, less than the two days available on the Knoxville market, and with comparable processing and Class I disposition patterns the operating reserve requirements would be increased. The approximate 107 percent of Class I sales maximum needed for a sufficient supply of milk on the Knoxville market is not too far out-of-line with the traditional recommendations of 110 percent. Thus greater credence should perhaps be given to this figure in setting supply-demand adjusters and if Class I quotas are instituted.

In comparing the supply and demand indexes, it was found that if the market has an adequate operating reserve for the month of October, the market would be adequately supplied the remainder of the year.

Loss from the farm to the plant was not considered in this study. Therefore, when the results herein reported are used, allowances should be made for any such loss that might occur. It is recommended that a study be made of the amount of loss from the farm pick-up in bulk tank to delivery at the plant.

A classification of the producer milk on the Knoxville market was made for 1963 to determine the amount that was operating reserve, seasonal reserve and surplus. An attempt was also made to determine if the market had the necessary operating reserve for the year. The market did not have sufficient operating reserve for October and November, 1963.

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APPENDIX

TABLE III

MILK DELIVERIES BY COOPERATIVE MEMBERS FOR THE TOTAL MARKET

	January 6 - 12		April 21 - 27		June 16 - 22		October 6 - 12		Sample Mean	
	Pounds	Percent of total	Pounds	Percent of total	Pounds	Percent of total	Pounds	Percent of total	Pounds	Percent of total
Sunday	403,960	11.6	680,679	17.3	427,131	12.2	382,685	11.2	473,614	13.2
Monday	530,818	15.2	543,207	13.8	515,749	14.8	514,446	15.1	526,055	14.7
Tuesday	514,668	14.8	520,795	13.2	569,352	16.3	487,816	14.3	523,158	14.6
Wednesday	473,211	13.6	557,694	14.2	427,783	12.3	527,482	15.4	496,543	13.9
Thursday	535,857	15.4	507,231	12.9	508,041	14.5	450,120	13.2	500,312	14.0
Friday	471,607	13.6	593,942	15.1	527,596	15.1	557,738	16.3	537,721	15.0
Saturday	550,864	15.8	531,061	13.5	517,512	14.8	493,393	14.5	523,208	14.6
Total	3,480,985	100.0	3,934,609	100.0	3,493,164	100.0	3,413,680	100.0	3,580,611	100.0

TABLE IV

RECEIPTS OF PRODUCER MILK BY THE SAMPLE HANDLERS FOR EACH SAMPLE PERIOD

	January 6 - 12		April 21 - 27		June 16 - 22		October 6 - 12		Sample Mean	
	Pounds	Percent of total	Pounds	Percent of total	Pounds	Percent of total	Pounds	Percent of total	Pounds	Percent of total
Sunday	206,689	10.4	207,045	10.7	150,448	8.2	121,187	6.6	171,342	9.0
Monday	343,279	17.2	282,682	14.6	284,674	15.5	284,807	15.4	298,861	15.7
Tuesday	318,138	15.9	268,460	13.8	334,281	18.1	288,802	15.6	302,420	15.9
Wednesday	196,921	9.9	307,450	15.8	192,449	10.4	296,975	16.1	248,449	13.0
Thursday	342,037	17.1	271,331	14.0	283,975	15.4	248,271	13.5	286,404	15.0
Friday	253,873	12.7	340,215	17.5	317,034	17.2	296,168	16.0	301,823	15.8
Saturday	336,006	16.8	264,364	13.6	280,707	15.2	310,551	16.8	297,907	15.6
Total	1,996,943	100.0	1,941,547	100.0	1,843,568	100.0	1,846,761	100.0	1,907,206	100.0

TABLE V

MILK PROCESSED BY THE SAMPLE HANDLERS FOR EACH SAMPLE PERIOD

	January 6 - 12		April 21 - 27		June 16 - 22		October 6 - 12		Sample Mean	
	Pounds	Percent of total	Pounds	Percent of total	Pounds	Percent of total	Pounds	Percent of total	Pounds	Percent of total
Sunday	--	--	--	--	--	--	--	--	--	--
Monday	344,073	19.7	313,963	19.0	303,770	19.2	327,141	18.5	322,237	19.1
Tuesday	336,544	19.3	315,485	19.1	296,071	18.7	327,371	18.5	318,868	18.9
Wednesday	104,426	6.0	94,595	5.7	101,695	6.4	108,467	6.1	102,296	6.1
Thursday	344,207	19.7	323,911	19.6	307,082	19.4	349,102	19.7	331,076	19.6
Friday	321,701	18.5	334,378	20.3	332,667	21.0	344,547	19.4	333,323	19.7
Saturday	292,874	16.8	268,883	16.3	242,331	15.3	315,403	17.8	279,873	16.6
Total	1,743,825	100.0	1,651,215	100.0	1,583,616	100.0	1,772,031	100.0	1,687,673	100.0

TABLE VI

WHOLE MILK EQUIVALENT OF THE MILK PROCESSED BY THE SAMPLE HANDLERS FOR EACH SAMPLE PERIOD

	January 6 - 12		April 21 - 27		June 16 - 22		October 6 - 12		Sample Mean	
	Pounds	Percent of total	Pounds	Percent of total	Pounds	Percent of total	Pounds	Percent of total	Pounds	Percent of total
Sunday	--	--	--	--	--	--	--	--	--	--
Monday	353,897	19.7	321,509	19.0	310,648	19.1	334,665	18.5	330,180	19.1
Tuesday	345,810	19.3	321,569	19.0	301,340	18.5	334,516	18.5	325,809	18.8
Wednesday	107,600	6.0	100,671	6.0	103,877	6.4	111,443	6.1	105,898	6.1
Thursday	354,156	19.8	333,111	19.7	324,873	20.0	357,370	19.7	342,378	19.8
Friday	329,891	18.4	341,145	20.2	339,190	20.9	352,762	19.5	340,747	19.7
Saturday	300,957	16.8	272,463	16.1	246,397	15.1	321,373	17.7	285,298	16.5
Total	1,792,311	100.0	1,690,468	100.0	1,626,325	100.0	1,812,129	100.0	1,730,310	100.0

TABLE VII

CLASS I DISPOSITION OF MILK BY THE SAMPLE HANDLERS FOR EACH SAMPLE PERIOD

	January 6 - 12		April 21 - 27		June 16 - 22		October 6 - 12		Sample Mean	
	Pounds	Percent of total	Pounds	Percent of total	Pounds	Percent of total	Pounds	Percent of total	Pounds	Percent of total
Sunday	8,794	0.5	8,744	0.5	10,161	0.7	9,821	0.6	9,380	0.6
Monday	304,492	17.9	269,729	16.8	256,813	16.9	285,195	16.7	279,057	17.1
Tuesday	282,959	16.7	251,004	15.6	228,912	15.0	256,797	15.1	254,918	15.6
Wednesday	221,093	13.0	219,699	13.7	203,670	13.4	253,047	14.9	224,377	13.7
Thursday	278,032	16.4	254,756	15.9	245,985	16.1	266,041	15.6	261,204	16.0
Friday	308,332	18.1	321,870	20.1	304,251	20.0	335,676	19.7	317,532	19.5
Saturday	295,197	17.4	278,334	17.4	271,881	17.9	297,136	17.4	285,637	17.5
Total	1,698,899	100.0	1,604,136	100.0	1,521,637	100.0	1,703,713	100.0	1,632,105	100.0

TABLE VIII

PROJECTED SUPPLY BASED UPON THE SEASONAL SUPPLY AND DEMAND INDEXES WHEN THE SUPPLY IS EQUAL TO THE CLASS I DISPOSITION PLUS OPERATING RESERVE DURING OCTOBER[a]

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Demand index	103.71	105.14	103.38	100.92	98.58	90.79	91.08	94.38	105.26	104.61	103.61	98.54
Supply index	98.19	100.99	100.19	108.20	106.90	100.29	97.39	97.29	99.49	97.49	96.99	96.59
Projected percent supply of demand	108.20	109.57	110.53	121.00	122.04	123.22	120.03	116.63	107.95	106.60	107.10	111.77

[a]The percent supply of demand was calculated with the formula $X = Y + (A - B) - (C - D)$ when
X = Projected percent supply of demand
Y = 106.60 (the demand plus sufficient operating reserve)
A = October demand index
B = October supply index
C = Demand index for the month projected
D = Supply index for the month projected

TABLE IX

COMPARISON OF HANDLERS ON KNOXVILLE, TENNESSEE MARKET AS OF JANUARY 1, 1964

Handler	Handler size[a]	Receipts Days	Processing Days	Sales Days	Type of Disposition[b]
A	M	Everyday	M,T,T,F,S	M-S	W,R
B*	L	Everyday[c]	M,T,T,F,S	M-S	W,R,D
C	M	Everyday	M,T,T,F,S	M-S	W,R
D	S	M-S	M-S	M-S	W,R,D
E	M	Every-other-day	M,T,T,F,S	M-S	W,R,D
F	M	Everyday	M-S	M-S	W,R,D
G	M	Everyday	M-S	M-S	W,R,D
H*	M	Everyday	M,T,T,F,S	M-S	W,R
I*	L	Everyday	M-S	M-S	W,R,D
J	S	Everyday	M,T,T,F,S	M-S	W,R,D

*Sample Handlers.

[a] Size classification: Large (L) - Over 2 million lbs. of Class I milk disposition monthly; Medium (M) - 1-2 million lbs. of Class I milk disposition monthly; and Small (S) - Less than one million lbs. of Class I milk disposition monthly.

[b] Wholesale (W), Retail (R), and Distributor (D) Sales.

[c] Sometimes do not receive on Sunday.