AN ECONOMIC ANALYSIS OF SEASONAL PRICING PLANS FOR CLASS I MILK IN THE OKLAHOMA MARKET

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CHAPTER I

INTRODUCTION

Milk production in Oklahoma follows a definite seasonal pattern. Production is highest during the spring months when pastures and forages are plentiful and lowest during the fall and early winter months when roughages provided by grazing are limited. For the 1950-1959 time period, milk production in Oklahoma was 26 per cent above average during May and 16 per cent below average during November and December.

Seasonal variability of production would not be serious if a comparable seasonal variation existed for consumption. However, consumption is relatively stable from month to month, and the little consumption seasonality existing is almost the opposite of the seasonality of production. Consumption of milk is highest in the fall and early winter and lowest in the spring and early summer. The lack of comparability in the seasonal variability of milk production and consumption would generate unstable milk prices to producers with the low price elasticity of demand (generally reported in the -0.2 to -0.5 range) unless alternative markets or controls existed.

Seasonal Pricing of Milk Under Federal Orders in Oklahoma

Until 1950, the milk processors and distributors in Oklahoma milksheds assumed the function of obtaining sufficient quantities of milk

for their operations. Differences in the needs of the individual plants were so variable that no uniform procedure was evident for either the pricing of milk at the farm or the method of handling the seasonality problem. For these and other reasons, Federal orders were established in the Tulsa and Oklahoma City milksheds, becoming effective in May, 1950 (1, p. 5). About one year later, a Federal order was also established in Muskogee (2, p. 4).

The procedure for establishing minimum prices paid to producers under Federal order market regulation in Oklahoma was similar to that used in surrounding markets operating under Federal orders. Minimum prices were based on prices of milk in alternative manufacturing uses plus a differential for producing Grade A rather than Grade C milk. The minimum price was to be set at a level which would insure an adequate quantity of milk on the market. Built into the minimum price concept was an incentive to producers to minimize the seasonal variation in production. In May, 1950, this incentive consisted of a reduction in the Class I differential of 40 cents per hundredweight for milk utilized as Class I during the months of April, May, and June.

It was apparent from the beginning of the Federal orders in the Oklahoma markets that a 40 cents per cwt. relative price reduction during the flush production months would not be sufficient to stimulate more even production from one month to the next. In 1951, a base-excess or base-surplus plan for each of the markets was adopted. Bases for producers were determined during the period September through December. Payments to producers during the subsequent designated flush production months were related directly to their individual bases. Production equal to or less than the base was valued at a weighted average base price. Production in excess of the base was valued at the Class II

price. Under this pricing system, each producer would have a slightly different blend price, and he would share in the Class I sales at Class I prices only through his base deliveries.

The base-surplus plan and a 40 cent per cwt. lower price during April, May, and June formed the program to reduce the seasonality of production in the Oklahoma milksheds for the remainder of the 1950 decade. However, at least a part of this program was rendered ineffective through bargaining arrangements. Late in 1954 the distributors and the Central Oklahoma Milk Producers Association in the Oklahoma City milkshed entered negotiations and agreed upon Class I prices, higher than order prices, that would be paid for producer milk. Negotiated prices were applicable through the spring and summer season of 1955. The effect of these negotiations was to nullify half or more of the 40 cent per cwt. reduction specified in the Federal order. Moreover, negotiated prices were used in subsequent years in the Oklahoma City market to eliminate most if not all of the specified per cwt. reduction in this market.

Conditions were not the same in the Tulsa milkshed. The Federal orders for Tulsa and Muskogee were combined on August 1, 1953, and both the 40 cents per cwt. reduction in price during April, May, and June and the base-surplus plan were effective throughout the remainder of the 1950 decade. This continued even though the Tulsa-Muskogee order had been merged with the Oklahoma City order in May, 1957 (2, p. 4). Only in 1960 did negotiated prices exist in the Tulsa milkshed which would nullify the 40 cent per cwt. reduction in Class I prices for the months of April, May, and June.

Although changes in seasonality of production were evident, producer groups asserted that the major effect of the base-surplus plan was to

provide an incentive for expansion of the level of production. Consequently, they asked for the elimination of the base-surplus plan from the Federal order. This request suggested that producer groups would handle the seasonality problem outside the Federal order framework. Alternatives faced by the producer groups appeared to range from a no-control program with an intensive system of marketing excess milk to a quota or base program for members only. The base-surplus plan was eliminated from Federal order No. 6 on July 1, 1960.

Objectives of Study

The lack of an analysis of adjustments occurring under existing programs led to this study of seasonal pricing plans for milk in Oklahoma milksheds. Also, there is need for information on adjustments likely to occur under alternative types of programs. This study has three major objectives: (1) to provide some knowledge as to how producers as a whole and individually have adjusted seasonal production patterns, stability of production, and the level of production under existing seasonal pricing plans, (2) to give some indication of the relative effects of four alternative pricing plans, and modifications thereof, on returns above feed costs for producers with various pattern types, and (3) to provide a logical basis for the proposal of an alternative pricing plan for leveling seasonality of production under the conditions of the Oklahoma Metropolitan milk market.

CHAPTER II

METHOD AND PROCEDURE

A study of seasonal pricing plans could be based on the seasonal variation in market receipts of Class I milk for the Oklahoma Metropolitan milk marketing area. However, in a market with a relatively large number of producers entering and leaving from one year to the next, a change in seasonal variation in market receipts may reflect only a change in the proportion of producers with a particular seasonal pattern rather than an adjustment by all producers to an economic incentive. Since the latter appears to be of most importance in an evaluation of seasonal pricing plans, this study is based primarily on records of a sample of producers.

The Sample

An attempt was made to obtain a sample of 200 producers in the Oklahoma Metropolitan milk marketing area who had been selling Grade A milk for the period, 1950-1960. The study is restricted to those producers who were selling Grade A milk at least 11 months of each year from May, 1950 through May, 1960 in Oklahoma milksheds. This restriction eliminated many producers from the study since the rate of entry into, and withdrawal from, the Grade A milk market by producers in Oklahoma has been relatively high.

The number of producers in the sample was to be evenly divided between the Oklahoma City and the Tulsa segments of the marketing area. However, the number of producers actually qualifying for inclusion in this sample was slightly different from the number needed. In the Oklahoma City milkshed, the first 100 producers were selected from a list of 110 producers submitted by the Market Administrator for the Oklahoma Metropolitan milk marketing area. In the Tulsa milkshed, only 88 producers were selected from the list supplied by the Market Administrator because this was the number of producers qualifying for inclusion in the sample.

The Market Administrator's records provided data on producer receipts, prices, and base deliveries of milk. Sufficient details were obtained to determine sizes and patterns of seasonal variations for each producer in each milkshed. Data on market deliveries (or sales) were converted from pounds to percentages of centered 12-month moving averages for analysis of seasonal patterns. The procedure for calculating centered 12-month moving averages is explained by Thomsen and Foote (3, pp. 322-323).

Classification Scheme

Each Grade A milk producer has a relatively unique seasonal production pattern and an analysis of changes in the seasonal production patterns of the 188 individual producers included in the study would be quite cumbersome. Consequently, a classification scheme was adopted which permitted the grouping of producers into more nearly homogeneous strata. The classification scheme includes four major criteria. The first criterion is location. Location is defined as either Oklahoma

City or Tulsa, the primary city or milkshed with which the producer is associated or in which he markets his production. The second criterion is year. The calendar year, January through December is used. The third criterion of the classification scheme is size of producer as related to Grade A milk production. Average monthly production for the calendar year is used to indicate producer size. Producer sizes are combined for subsequent analysis into either three major or nine minor groups. These size groups are presented in Table I.

TABLE I

PRODUCER SIZE CLASSIFICATIONS

Size Codes		Average Monthly Production
Major	Minor	(pounds)
A	1	0 - 4,999
	2	5,000 - 9,999
B	3	10,000 -14,999
	4	15,000 -19,999
C	5	20,000 -24,999
	6	25,000 -29,999
	7	30,000 -34,999
	8	35,000 -39,999
	9	40,000 and greater

As shown in Table I, for example, a producer classified as size B, a major size group, for a certain year has an average monthly production for the year equal to or greater than 10,000 pounds of milk, but less than 20,000 pounds of milk. A size 3 producer, a minor size group, includes production of 10,000 through 14,999 pounds of milk per month.

The fourth criterion in the classification scheme is pattern type. Pattern type actually encompasses a dual criteria of depicting the

relative instability of monthly production and the seasons of the year when the highs and lows in production occur.

The first factor of pattern type, magnitude or relative instability of monthly production, refers to the general level of seasonal variation. The producer magnitude classification indicates the relative fluctuation of production from one month to the next within a year. With respect to magnitude, a production pattern is classified as stable, intermediate, or unstable (coded as 1, 2, and 3, respectively). The criterion for grouping was arbitrarily selected in such a manner that some producers would be represented in each group.

A stable production pattern is defined as one in which the milk marketed each month (pounds) during the year varies less than 20 per cent from the 12-month moving average of production. Such a pattern is classified as magnitude 1, and the range of variation for each magnitude classification is illustrated in Figure 1. An intermediate production pattern, magnitude 2, is defined as one in which the milk marketed varies at least 20 per cent, but less than 40 per cent, from the 12-month moving average of production in at least one month during the year. A production pattern is defined as unstable or magnitude 3 if production during at least one month out of the year fluctuates as much as 40 per cent from the 12-month moving average of production.

The second factor in determining pattern type is the period of the year in which production is above average or below average. Each year was divided into four seasons for the purpose of classifying producers with respect to seasonal production patterns. These four seasons are (1) winter, (2) spring, (3) summer, and (4) fall. Each season is defined as three consecutive months in the year as follows: (1) winter -

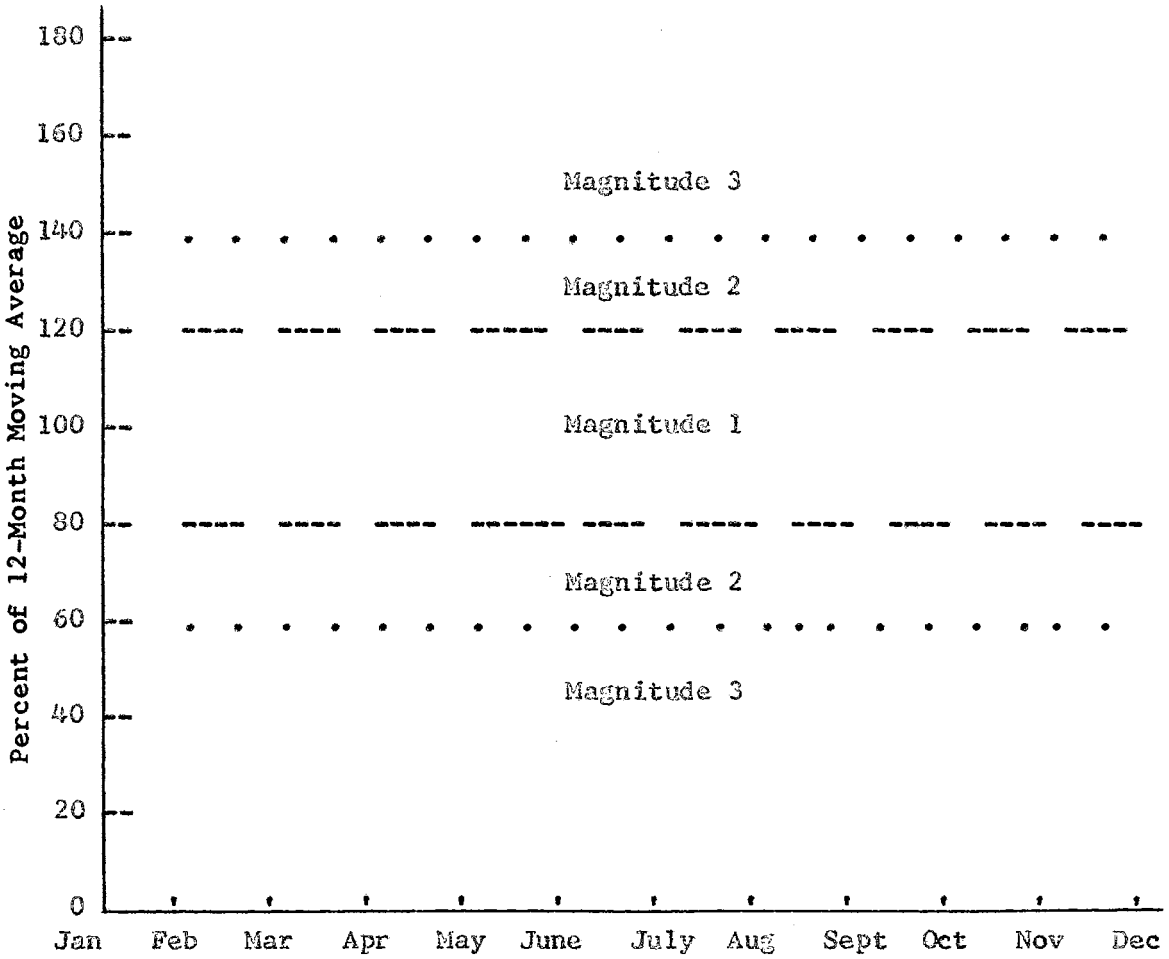

Figure 1. Illustration of Ranges of Variation for Producer Magnitude Classifications.

January, February, and March; (2) spring - April, May, and June; (3) summer - July, August, and September; and (4) fall - October, November, and December. These four seasons of the year are coded as 1, 2, 3, and 4, respectively. No seasonal high or low pattern is evident for some producers. In these cases, the pattern code is 6.

Two criteria are met before a producer pattern may be classified as a particular seasonal high or seasonal low pattern type. The first criterion is a magnitude 2 or 3 classification. A magnitude 1 or stable producer is considered ineligible for this classification, although a

definite pattern may have been followed within the arbitrary range of 20 per cent above or below average production. The second criterion is evidence of a regular production fluctuation resembling a pattern during the year. The existence of the two criteria was established by inspection of the percentages of the 12-month moving average for each producer during a given year. Table II depicts the various possible

TABLE II

PRODUCTION PATTERN CLASSIFICATIONS[a]

Seasonal High	Seasonal Low				
	Winter(1)	Spring(2)	Summer(3)	Fall(4)	None(6)
Winter(1)	-	(1-2)	(1-3)	(1-4)	(1-6)
Spring(2)	(2-1)	-	(2-3)	(2-4)	(2-6)
Summer(3)	(3-1)	(3-2)	-	(3-4)	(3-6)
Fall(4)	(4-1)	(4-2)	(4-3)	-	(4-6)
None(6)	(6-1)	(6-2)	(6-3)	(6-4)	(6-6)

[a]The first digit designates the season in which the high in production for any one year occurs, and the second digit designates season in which the low in production occurs.

production pattern classifications. The first code number in Table II signifies the seasonal high, and the second code number indicates the seasonal low of production. For example, consider the 2-4 seasonal pattern classification. This classification indicates that a producer (1) is classified as a magnitude 2 or 3, (2) exhibits some regularity in the seasonality of production, (3) has production during a single year which tends to be highest during the three months defined as the

spring season, and (4) has relatively low production during the fall season. The same criteria and procedure were used in the classification of all producers as to their seasonal production patterns for each of the nine years, 1951-1959.

Method of Analysis

Adjustments in Seasonal Production Patterns

In order to determine gross adjustments by producers with respect to changes in magnitude and size, a simple counting procedure was utilized. In each market, the total number of producers in each size group during each year, and the total number of producers within each magnitude classification in each size group, were tabulated.

Trends were computed for the changing number of producers in each seasonal high or seasonal low classification over the time period of the study. In these computations, the equation is of the following form:

$$\hat{Y} = a + bx \qquad (2.1)$$

The independent variable (x) is defined as time, coded as 1 = 1951, 2 = 1952 ...., and the dependent variable (Y) is defined as the number of producers in each sub-group (such as Oklahoma City, size group A, winter-high) expressed as a percentage of the total number of producers in that sub-group (such as Oklahoma City, size group A, all patterns) during a given year. The slopes of the various trend lines were tested for statistical significance with the "Students" t-test explained by Snedecor (4, p. 45). These trend lines, along with the tests of significance, were used as the basis for aggregating some of the individual patterns and sizes into sub-groups for further analyses.

In order to determine how individual producers having different seasonal production patterns adjusted their seasonal pattern and magnitude in response to changing market and price conditions, the 1951-1959 time period was divided into two periods, 1951-1954 and 1955-1959. The seasonal pricing plans used in the two markets were about the same during the first period, 1951-1954, and it was assumed that adjustments in seasonal patterns and magnitudes might be similar in each market. The distribution of producers among pattern-type classifications in 1954 as compared with the distribution in 1951 forms the basis for evaluating changes or adjustments in these patterns. During the second time period, 1955-1959, the seasonal pricing plans differed in the two markets, and it was assumed that changes in seasonal production patterns and magnitudes of various size producers for each market reflect the differences in the pricing procedures. Again, the distribution of producers among classifications in 1959 as compared with 1955 is used to evaluate changes in seasonal production patterns.

After the major changes occurring in the markets under existing seasonal pricing plans were observed for gross numbers, the data were refined. The first step in this refinement process was the use of analysis of variance techniques. Initially, analyses of variance were calculated for the two markets combined, next for each of the two markets individually, and finally for selected basic patterns of production with markets combined in some cases and separated in others depending on whether the basic patterns were significantly different in the two markets.

Returns and Cost Computations

The probable effects of alternative pricing plans on seasonality of production are analyzed for the basic patterns of production, selected on the basis of analyses in Chapters III and IV. Gross income and returns over feed costs for representative patterns are estimated for four basic seasonal pricing plans. These are as follows: (1) Uniform-Blend Plan, (2) Base-Surplus Plan I, which is about the same as the plan existing prior to 1960, (3) Louisville Type Plan or a"take-off and pay-back" Plan, and (4) Base-Surplus Plan II, which incorporates the concept of a year-around base. Each of these plans is defined in Chapter V. Returns over feed costs provide information as to the relative economic incentives to producers under each plan to attain a more stable monthly production pattern.

The different prices necessary for deriving the gross revenue of various size producers having different seasonal patterns of production under each of the four alternative pricing plans, and the analytical procedure followed in deriving these prices, will be explained in the sections dealing with these alternative plans. However, these prices are based on various combinations of assumed Class I and Class II prices. For all pricing plans, Class I prices are assumed to be consistent with about 78 per cent utilization for the market. That is, 78 per cent of the total quantity of milk marketed per production year is assumed to be used in fluid form as Class I Milk. This percentage is the highest average annual utilization percentage consistent with the provision of an 85 per cent utilization or an approximate 17 per cent surplus on the market during the month in which production is "shortest"

relative to consumption, based on average seasonal production and consumption pattern.

The Class I milk price is the average of the basic formula prices actually utilized in the Oklahoma Metropolitan market for a given month during the six years, October, 1955 through September, 1960, plus a Class I differential. For example, the January basic formula prices actually paid in the market during each of the six years, when summed and averaged, resulted in an average January basic formula price of $3.607 per cwt. (Table III). To this average is added a Class I differential of $1.95 as provided for in the Federal order to determine the Class I price of $5.557 per cwt. Prices for each of the other 11 months were calculated in a similar manner. These prices are about the same as the negotiated prices established for the Oklahoma City area.

The Class II milk prices used in this study are included in Table IV. They are averages of the Class II milk prices actually paid in the market in the respective months during the same six-year time period as used for Class I prices.

Total cost of production is the summation of the products of factor or input prices and the quantity of the respective factor inputs used in the production process over a given period of time. Total cost then is some function of the level of output, the type of factor inputs used, resource prices, and production efficiency. In this study, total costs are not computed. Only feed costs are considered. These costs generally make up about one-half of the total costs of producing fresh fluid milk. This approach will ignore seasonality of costs of other inputs, particularly labor. Feeds considered include roughage supplied

TABLE III

MONTHLY BASIC FORMULA AND ASSUMED CLASS I MILK PRICES, OKLAHOMA METROPOLITAN MILK MARKETING AREA, OCTOBER, 1954 - SEPTEMBER, 1960

Years	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
						(Dollars per cwt.)						
1954										3.434	3.551	3.605
1955	3.590	3.521	3.464	3.448	3.362	3.323	3.328	3.332	3.429	3.499	3.557	3.608
1956	3.609	3.571	3.521	3.477	3.459	3.459	3.477	3.495	3.521	3.638	3.674	3.721
1957	3.731	3.719	3.690	3.624	3.541	3.505	3.495	3.477	3.499	3.538	3.583	3.600
1958	3.595	3.581	3.554	3.522	3.378	3.310	3.303	3.338	3.383	3.423	3.474	3.490
1959	3.510	3.499	3.497	3.445	3.374	3.335	3.323	3.352	3.389	3.470	3.541	3.595
1960	3.605	3.575	3.565	3.537	3.465	3.426	3.429	3.445	3.515			
Average Formula Price	3.607	3.578	3.548	3.509	3.430	3.393	3.392	3.406	3.456	3.500	3.563	3.603
Differential	1.950	1.950	1.950	1.950	1.950	1.950	1.950	1.950	1.950	1.950	1.950	1.950
Assumed Class I Price[a]	5.557	5.528	5.498	5.459	5.380	5.343	5.342	5.356	5.406	5.450	5.513	5.553

Source: U. S. Department of Agriculture, Agricultural Marketing Service, Compilation of Statistical Material for the Oklahoma Metropolitan Milk Marketing Area, January 1954-March 1961 (Prepared by Market Administrator, Federal order No. 6), Table V.

[a] The annual average is $5.449 per cwt.

TABLE IV

MONTHLY CLASS II MILK PRICES, OKLAHOMA METROPOLITAN MILK MARKETING AREA, OCTOBER, 1954 - SEPTEMBER, 1960

Years	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	(Dollars per cwt.)											
1954										3.055	3.154	3.195
1955	3.195	3.132	3.088	3.075	3.016	3.013	3.025	3.028	3.085	3.125	3.150	3.135
1956	3.165	3.158	3.110	3.095	3.160	3.160	3.160	3.160	3.160	3.170	3.238	3.239
1957	3.240	3.240	3.180	3.148	3.093	3.097	3.103	3.162	3.221	3.226	3.244	3.262
1958	3.262	3.262	3.228	3.122	3.113	3.144	3.163	3.163	3.245	3.248	3.250	3.252
1959	3.252	3.252	3.260	3.183	3.153	3.154	3.155	3.153	3.166	3.200	3.219	3.238
1960	3.240	3.243	3.233	3.181	3.117	3.117	3.117	3.129	3.238			
Average[a] Prices	3.226	3.214	3.183	3.134	3.109	3.114	3.120	3.132	3.186	3.171	3.209	3.220

Source: U.S. Department of Agriculture, Agricultural Marketing Service, Compilation of Statistical Material for the Oklahoma Metropolitan Milk Marketing Area, January, 1954 - March, 1961 (Prepared by Market Administrator Federal order No. 6), Table III.

[a]The annual average is $3.168 per cwt.

by pasture, purchased roughage, and concentrates.

In order to arrive at an estimate of the pounds of roughage supplied by pasture during each of the various months of a production and marketing year, data from Underwood's study (5, p. 13) were used. In Underwood's study, the Oklahoma City milkshed was divided into three areas or regions as follows: (1) northwestern, (2) southwestern, and (3) eastern. For each of the three areas, data were reported for (a) the total acres of pasture from wheat and oats, both the acreage planted for grain and for pasture, (b) the total acres of native pasture, and (c) the total acres of Sudan grass pasture.

Estimates for the present study of the availability of roughage from pastures were made in the following manner. Each of the various feed input acreages in each of the three areas was expressed as a percentage of the total number of acres of these feeds. Using Underwood's estimates of the animal unit days of full forage per acre for each month of the year provided by each feed, an estimate of the number of animal unit days of full forage supplied by pasture for each month of the year was calculated for the Oklahoma City milkshed (Table V). In these calculations, the greatest amount of pasture is available to producing animals during the month of June.

The major assumptions involved in the computation of total feed costs per hundredweight of milk produced and marketed are the following:[1] (1) the typical cow produces 9,000 pounds of four per cent butterfat

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[1] The various assumptions were made in consultation with Dr. Lynn Bush, Department of Dairy Husbandry, and Dr. Clark Edwards, Department of Agricultural Economics, Oklahoma State University. All assumptions with respect to feed requirements and herd replacements were checked with Dr. Lynn Bush although the responsibility for these assumptions rests with the author.

TABLE V

SELECTED STATISTICS ON MONTHLY POUNDS OF ROUGHAGE SUPPLIED BY PASTURE, CENTRAL OKLAHOMA

	Northwestern Section		Southwestern Section		Eastern Section	
	Acres	% of Total	Acres	% of Total	Acres	% of Total
Wheat(grain)	10,785	48.60	2,231	27.61	410	3.45
Wheat(pasture)	165	.74	83	1.03	-	-
Native Pasture	9,613	43.31	4,942	61.15	10,696	90.19
Oats(grain)	848	3.82	113	1.40	487	4.11
Oats(pasture)	67	.30	326	4.03	97	.82
Sudan Grass	716	3.23	386	4.78	170	1.43
Total	22,194	100.00	8,081	100.00	11,860	100.00

Northwestern	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Wt. A.U.D.	.46	.42	.32	.75	1.65	2.03	1.86	1.38	.77	.60	1.31	1.50
% of Total	3.52	3.22	2.45	5.75	12.64	15.56	14.25	10.57	5.90	4.60	10.04	11.49

Southwestern	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Wt. A.U.D.	.16	.24	.74	1.45	2.83	3.28	3.22	2.70	1.97	1.28	1.10	1.17
% of Total	.79	1.19	3.67	7.20	14.05	16.29	15.99	13.41	9.78	6.36	5.46	5.81

Eastern	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Wt. A.U.D.	.39	.34	.36	.63	2.10	2.61	2.14	1.61	1.27	.66	.35	.32
% of Total	3.05	2.66	2.82	4.93	16.43	20.42	16.74	12.60	9.94	5.16	2.74	2.50

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Mean Percentage	2.45	2.36	2.98	5.96	14.37	17.42	15.66	12.19	8.54	5.37	6.08	6.60
% of June	14.06	13.55	17.11	34.21	82.49	100.00	89.90	69.98	49.02	30.83	34.90	37.89
lbs. of Roughage[a]	68.80	66.30	83.80	167.50	403.80	489.50	440.10	342.60	240.00	150.90	170.80	185.50

Source: F. L. Underwood, Economic Survey of Resources Used by Dairy Farmers in Oklahoma, Oklahoma Agricultural Experiment Station Bulletin No. B-482 (Stillwater: Oklahoma A & M College, 1956), Table 13.

[a]Computed as percentage of 489.5 pounds per month.

content milk every ten months or about 900 pounds per month for a 300-day lactation period, (2) this typical cow is fed 9,492 pounds of roughage and 2,700 pounds of concentrate feeds in a year's production period (10 months) as recommended by Morrison (6, p. 676), (3) producing animals receive one-half ration during the two months that they are dry, (4) one-half of a typical cow's roughage requirement is supplied by pasture during the peak of the pasture season and roughage is supplied by pasture in other months in proportion to the percentage that the animal unit days of full forage in those months is of the June total, (5) alfalfa hay is used for the balance of the roughage requirements, (6) the herd replacement rate is one-fourth or, in different terms, a producer's entire herd is replaced once every four years,[2] (7) total feed costs for a replacement animal are only one-half of those necessary for a producing animal in one production period. Based on these assumptions, the feeding rate is 278 pounds of concentrates and 979 pounds of roughage per month for each producing animal in the herd.

The prices of the basic feed inputs used in this study are $25 per ton or $0.125 per pound for alfalfa hay and $2.84 per 100 pounds or $0.0284 per pound for concentrate mixed feed. The alfalfa hay price per ton is the average of 1960 monthly prices (7, p. 47). The annual average price of alfalfa hay was multiplied by the index of seasonal variation in alfalfa hay prices prepared by Walker (8, p. 31) to obtain monthly prices. These monthly prices and related statistics are given

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[2] The replacement rate required for maintenance of existing herds is about one-fifth. However, many herds in Oklahoma are expanding and producers tend to keep a larger number of replacements for this purpose. The assumption of one-fourth, therefore, is arbitrary and may, in fact, understate the actual number of replacement animals on many farms.

in Table VI. The price of roughage from pasture, per pound, is assumed to be one-half of the price of a pound of purchased roughage. The concentrate feed price per hundredweight is the average of two 1960 price series. The first series is based on prices paid by farmers for 16 per cent protein mixed dairy feed (9, p. 137). The second series is based on unpublished prices of mixed dairy feed as used in computing Oklahoma milk-feed price ratios. An index of seasonal variation of prices of mixed dairy feed, as computed for the price ratios, was multiplied by $2.84 to obtain monthly prices of concentrates. These calculated feed prices, when multiplied by the respective quantities of concentrates, pasture, and alfalfa hay utilized per month, and summed, yielded the monthly total feed costs associated with each 9,000 pound producing animal in the herd under the various assumptions. The monthly total feed costs were then expressed as monthly costs per hundredweight of milk produced. The total feed costs per hundredweight for each producer of a given size with a given production pattern are assumed constant and independent of the specific seasonal pricing plans in operation for producers.

There are several limitations to the feed cost data utilized in estimating producer returns above feed costs under the alternative pricing plans. The more obvious limitations are (1) only a few of the many different types of feeds available were considered in the calculation of feed costs, (2) the animal unit days of forage supplied by pasture and prices of various roughages and concentrates are satisfactory estimates only under the assumed Oklahoma market conditions and do not necessarily apply to a given farm in a given year, and (3) the

TABLE VI

SELECTED STATISTICS ON FEED PRICES AND ASSUMED FEED COSTS PER MONTHS AND PER CWT., OKLAHOMA

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Index of Seasonal Variation of Feed Prices												
Alfalfa Hay	112.2	110.8	107.0	104.5	92.0	82.7	85.3	91.7	96.0	102.4	105.9	109.5
Concentrates	102.2	102.2	102.3	103.4	103.9	97.7	97.4	98.0	96.7	96.4	98.7	100.7
Calculated Feed Prices, Per Pound[a/]												
Alfalfa Hay	1.40	1.39	1.34	1.31	1.15	1.03	1.07	1.15	1.20	1.28	1.32	1.37
Concentrate	2.90	2.90	2.91	2.94	2.95	2.77	2.77	2.78	2.75	2.74	2.80	2.86
Pasture	.70	.70	.67	.66	.58	.52	.54	.58	.60	.64	.66	.68
Calculated Feed Costs, Per Month												
Concentrates	8.06	8.06	8.09	8.17	8.20	7.70	7.70	7.73	7.64	7.62	7.78	7.95
Alfalfa Hay	12.74	12.66	12.00	10.63	6.62	5.04	5.77	7.32	8.86	10.60	10.67	10.87
Pasture	.48	.46	.56	1.10	2.32	2.52	2.35	1.97	1.44	.97	1.13	1.27
Total Feed Costs	21.28	21.20	20.65	19.90	17.14	15.26	15.82	17.02	17.94	19.19	19.58	20.09
Feed Costs Per Cwt. Of Production	2.36	2.36	2.29	2.21	1.90	1.70	1.76	1.89	1.99	2.13	2.18	2.23

a/ Annual prices used are $25.00 per ton for alfalfa hay, $2.84 per cwt. for concentrate, and 0.625 cents per pound for roughage supplied by pasture.

assumptions concerning cow production capacity, feeding rates, and replacement rates will vary with the level of management, with the quantities of capital, labor, and other resources available, and with individual farm operators.

Total revenue and feed costs for an "ideal" pattern producer are calculated for comparison with the selected number of various size producers having different seasonal patterns of production under each of the four alternative seasonal pricing plans. The "ideal" pattern is defined as a perfectly level pattern with 100 per cent of the monthly average production sold each month. Incentives to change from one seasonal production pattern to another are determined on the basis of two standards of comparison. The first is in terms of differences of returns over feed costs from the potential as depicted by the seasonal production pattern of the "ideal" producer under the particular plan under consideration. The second is in terms of differences of returns over feed costs from the same "ideal" producer operating under a uniform blend pricing plan.

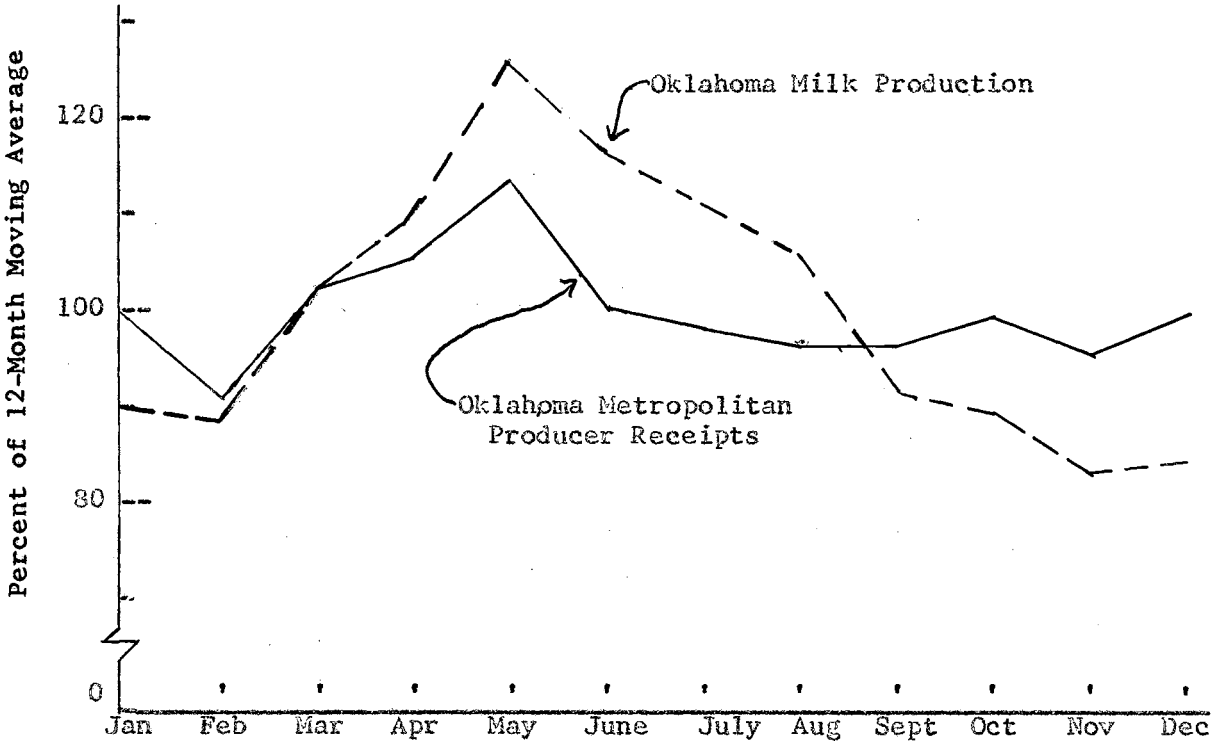
CHAPTER III

MARKET AND INDIVIDUAL PRODUCER ADJUSTMENTS IN SEASONAL VARIATION OF PRODUCTION

Market Adjustments

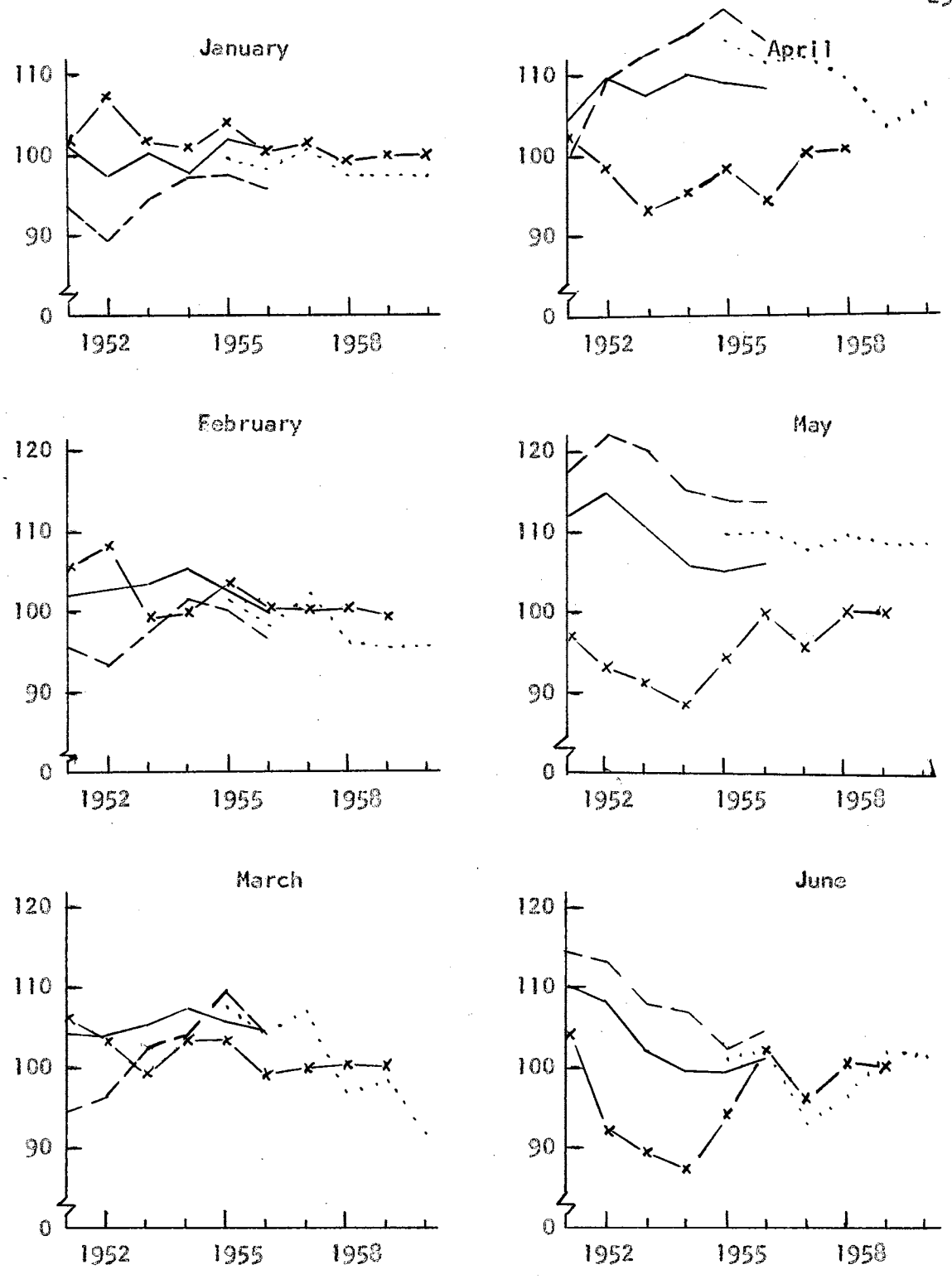
The average seasonal variation in Oklahoma milk production and in monthly producer receipts of Grade A milk for the aggregate Oklahoma Metropolitan milk marketing area are illustrated in Figure 2. Generally, production is highest in the spring months as compared with the other months. The variation is considerably less for the area than for milk production in the state as a whole. The fluctuation in receipts from month to month is somewhat exaggerated since each month does not include the same number of days. February is the extreme case with an indicated decline of about 8 per cent. Actually, daily average production increases from January through May.

The average pattern of seasonal fluctuation in producer receipts appears to conceal important changes in this pattern since 1951. Consequently, percentages of 12-month moving averages for daily average production were computed. These are shown by months in Figures III and IV. Three different series used are Oklahoma City, Tulsa-Muskogee, and the combined Oklahoma City and Tulsa-Muskogee markets. Also, percentages of 12-month moving averages are shown for the Class I price



Source: Appendix Table VI and Computations from U. S. Department of Agriculture, Statistical Reporting Service, Milk Production Dal-1 (February, 1962), Table 7.

Figure 2. Average Seasonal Variation in Oklahoma Milk Production and Oklahoma Metropolitan Area Producer Receipts, 1950-1959.



Legend: —— Oklahoma City Production Per Producer
---- Tulsa-Muskogee Production Per Producer
.... Combined Market Production Per Producer
x-x- Oklahoma City Class I Price

Figure 3. Percentages of 12-Month Moving Averages for Class I Prices in the Oklahoma City Market and for Daily Average Production Per Producer in the Oklahoma City, Tulsa, and Combined Markets, Winter and Spring Months, 1951-1960.

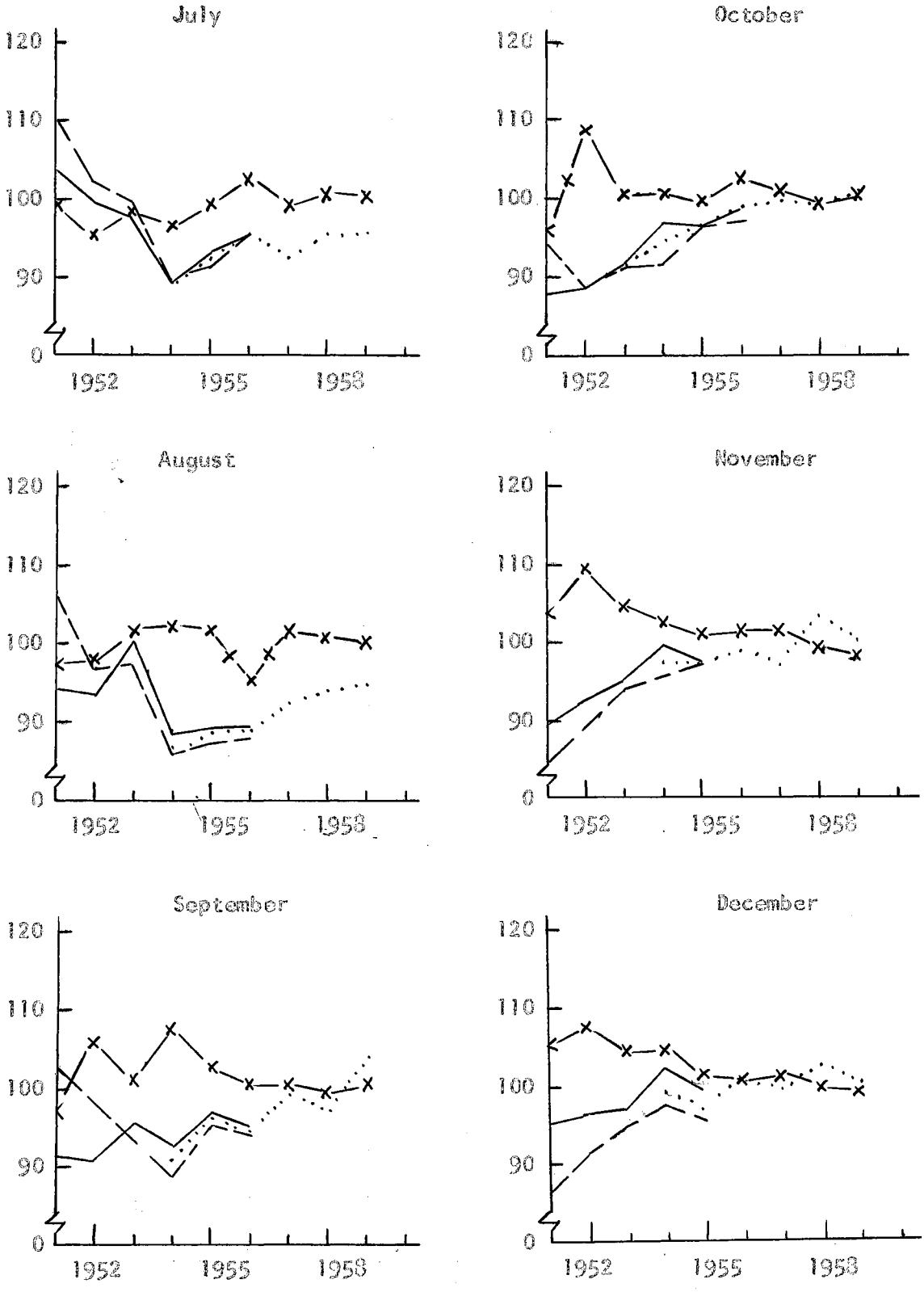


Figure 4. Percentages of 12-Month Moving Averages for Class I Prices in the Oklahoma City Market and for Daily Average Production Per Producer in the Oklahoma City, Tulsa, and Combined Markets, Summer and Fall Months, 1951-1960.

effective in the Oklahoma City area.

Initially, daily average production during the winter season months was above average in the Oklahoma City milkshed and was below average in the Tulsa milkshed. Under Federal order pricing there was a tendency for differences between the two market series to become smaller, with daily average production increasing relatively in the Tulsa milkshed from 1951 through 1954. After 1954, daily average production for the combined market declined significantly in the winter months, particularly in March, and to some extent, in February.

Trends were mixed during the spring season months. For both markets, daily average production in April increased, relative to the moving average, from 1951 to about 1954 or 1955 with price trending downward. After 1955, daily average production for the combined markets declined even though prices were relatively stable. In May, a general decline in daily average production occurred from 1951 to 1955 then production stabilized. This was directly related to the price movements during this period. In June, the daily average production percentage for all series declined from 1951 through 1957, then increased. June prices either increased slightly or were relatively stable over the complete period. Over-all, some decline in production during the spring months was evident. Presumably some of this decline resulted from the use of the base-surplus plan.

Trends were also mixed during the summer months. From 1951 through 1954, the daily average production percentage decreased during each month in the Oklahoma City area. The daily average production percentage in Tulsa either decreased or moved to a level which compared closely

with Oklahoma City. After 1954, there was some tendency for the daily average production percentages for the combined markets to increase even though relative prices were stable.

Daily average production as a percentage of the 12-month moving average increased during the fall months over the complete period. Generally, prices during the fall were either steady or declining over the same period. It appears that production was increasing during the fall partially as a result of producers establishing individual bases for subsequent payments rather than producers reacting to changing seasonal prices during these months.

Adjustments Made by Sample Producers

The average seasonal variation in monthly producer receipts for the sample of 188 producers indicated approximately the same seasonal variation as existed for the complete market (Figure 5). Production averaged slightly higher during the spring and summer months and slightly lower from September through December for the producers included in the sample than for the total market. Generally, however, the seasonality of production for producers included in the sample appeared comparable with the seasonality of production for the market.

Changes in Size

Seasonal variation in production could be related to the size of the dairy enterprise. In this study size is measured in terms of pounds of milk produced per month which is related to the dollar income of the farm business. It is not unreasonable to expect less effort devoted to maximizing dollar returns from a minor enterprise than from a major

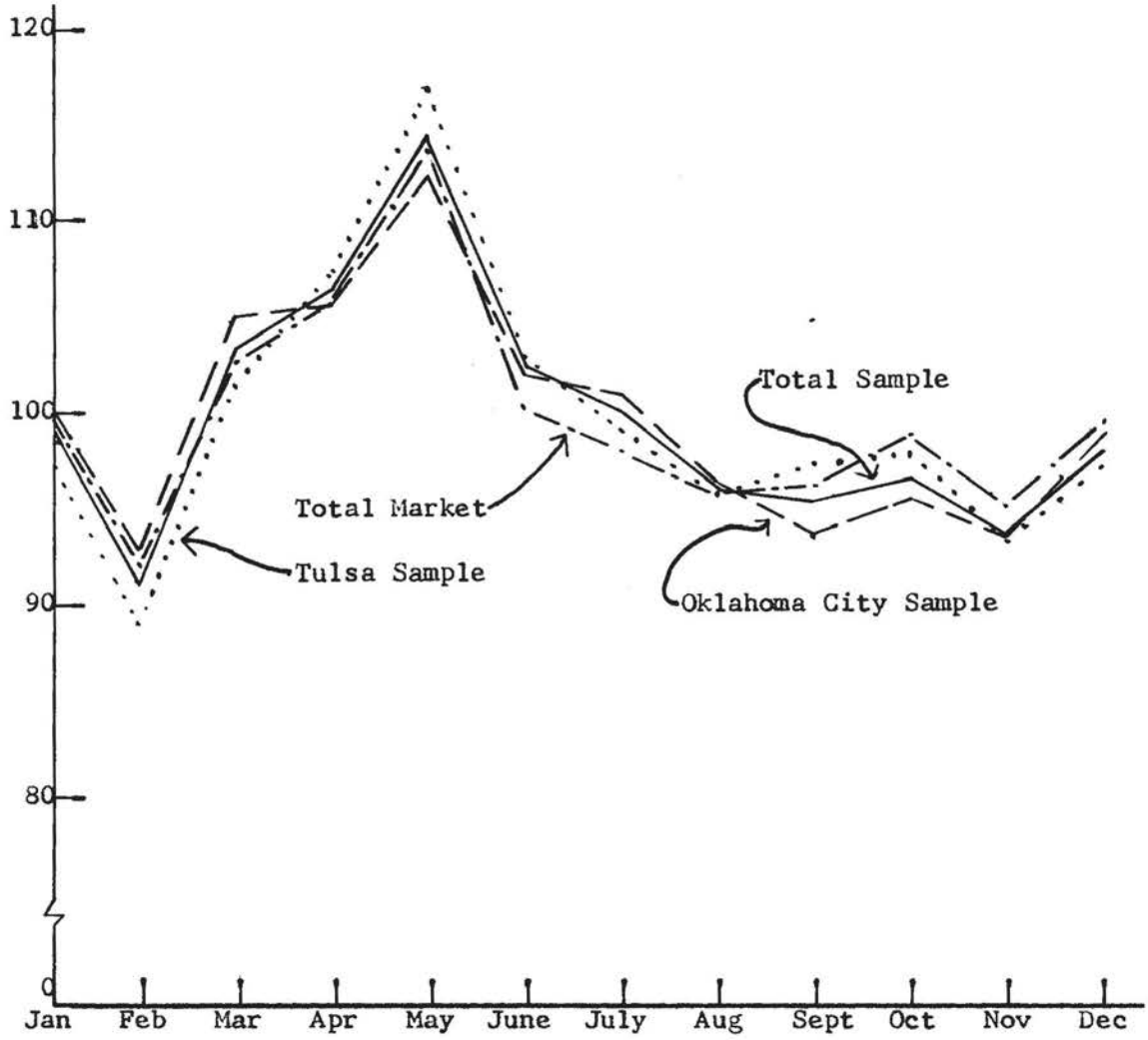


Figure 5. Average Seasonal Variation in Producer Receipts for the Oklahoma Metropolitan Area and for Oklahoma City, Tulsa, and All Producers Included in the Sample, 1951-1959.

enterprise. Therefore, changes in size alone may be responsible for some change in seasonal variation of production.

The relative proportion of producers in each major size group in each market is included in Table VII. In the Oklahoma City market, there was a steady decline in the proportion of size A producers while the proportion of size B and C producers increased. In 1951, 68 per cent of the producers in this market were classified as small while

TABLE VII

PERCENT OF PRODUCERS IN MAJOR SIZE GROUPS, OKLAHOMA CITY AND TULSA MILKSHEDS, 1951-1959

Market	Size Group	1951	1952	1953	1954	1955	1956	1957	1958	1959
						(Percent)[a]				
Oklahoma City	A	68.0	60.0	55.0	55.0	49.0	39.0	32.0	30.0	30.0
	B	28.0	34.0	34.0	35.0	37.0	45.0	46.0	42.0	35.0
	C	4.0	6.0	11.0	10.0	14.0	16.0	22.0	28.0	35.0
Tulsa	A	36.4	39.8	27.3	25.0	27.3	19.3	25.0	20.5	22.7
	B	45.4	42.0	48.8	50.0	44.3	48.9	42.0	44.3	35.2
	C	18.2	18.2	23.9	25.0	28.4	31.8	33.0	35.2	42.1

[a]Expressed as a per cent of 100 in Oklahoma City and as a per cent of 88 in Tulsa.

only 4 per cent were classified as large. By 1959, only 30 per cent of the producers in Oklahoma City were in the small size group while 35 per cent were classified as large size producers.

In the Tulsa market, the proportion of large size producers also increased substantially. There was a somewhat erratic relative decline in size A and size B producer numbers. However, the increase in number of producers classified as size C consistently increased over the nine-year period. The proportion of size C producers was greater in Tulsa than in Oklahoma City, but the difference in the proportions for the two markets was smaller in 1959 than in 1951. Also, the proportion of small size producers was less in Tulsa than in Oklahoma City during all years. These proportions reflect the higher daily average production of producers in the Tulsa market as compared with the Oklahoma City market.

Changes in Magnitude of Seasonal Variation

The number of producers exhibiting each magnitude within each size group for each market is listed in Table VIII. Considering all producer sizes together in the Oklahoma City market for the period 1951 through 1959, the total number of magnitude 1 producers remained about the same, the total number of magnitude 2 producers increased, and the total number of magnitude 3 producers declined.[3] Therefore, in terms of gross producer numbers during the years 1951-1959, production tended to become more stable in the Oklahoma City milkshed. In a similar comparison for the Tulsa milkshed, the total number of producers with the various magnitudes remained about the same. Therefore, the stability of production in the Tulsa milk market appeared to be about the same in 1959 as in 1951.

In order to determine whether the decrease in magnitude occurred within each size group or whether it reflected individual producers changing their production levels, a further classification was made. The number of producers classified as magnitude 1, 2, 3 were expressed as a percentage of the total number of producers in the respective size groups A, B, or C for each market for each year under consideration (Table IX). These percentages indicate whether production tended to become more stable, less stable, or to remain the same within each size group.

For the size A producers in the Oklahoma City market, there was a decrease in the percentage of magnitude 1 and magnitude 3 producers. The percentage of magnitude 2 producers increased from 1951 to 1959.

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[3] For definitions of these terms, see page 8.

TABLE VIII

NUMBER OF PRODUCERS IN MAGNITUDE CLASSIFICATIONS WITHIN MAJOR SIZE GROUPS, OKLAHOMA CITY AND TULSA MILKSHEDS, 1951-1959

Market	Size Group	Magnitude	1951	1952	1953	1954	1955	1956	1957	1958	1959
Oklahoma City (1)	A	1	5	4	2	3	1	3	2	1	0
		2	23	25	31	30	19	13	13	16	16
		3	40	31	22	22	29	23	17	13	14
		Total	68	60	55	55	49	39	32	30	30
	B	1	4	6	1	6	9	5	6	5	4
		2	15	17	19	19	23	29	28	26	20
		3	9	11	14	10	5	11	12	11	11
		Total	28	34	34	35	37	45	46	42	35
	C	1	0	0	5	1	1	2	4	5	6
		2	4	6	3	6	9	9	11	17	24
		3	0	0	3	3	4	5	7	6	5
		Total	4	6	11	10	14	16	22	28	35
	Combined	1	9	10	8	10	11	10	12	11	10
		2	42	48	53	55	51	51	52	59	60
		3	49	42	39	35	38	39	36	30	30
Tulsa (2)	A	1	1	1	0	1	1	1	1	0	1
		2	13	16	11	12	11	9	6	5	8
		3	18	18	13	9	12	7	15	13	11
		Total	32	35	24	22	24	17	22	18	20
	B	1	5	6	2	6	8	6	3	3	3
		2	23	22	26	23	18	19	15	20	14
		3	12	9	15	15	13	18	19	16	14
		Total	40	37	43	44	39	43	37	39	31
	C	1	2	1	5	4	2	5	5	3	5
		2	9	13	11	15	18	14	18	25	21
		3	5	2	5	3	5	9	6	3	11
		Total	16	16	21	22	25	28	29	31	37
	Combined	1	8	8	7	11	11	12	9	6	9
		2	45	51	48	50	47	42	39	50	43
		3	35	29	33	27	30	34	40	32	36

TABLE IX

PERCENTAGE OF PRODUCERS IN MAGNITUDE CLASSIFICATIONS WITHIN MAJOR SIZE GROUPS, OKLAHOMA CITY AND TULSA MILKSHEDS, 1951-1959

Market	Size Group	Magnitude	1951	1952	1953	1954	1955	1956	1957	1958	1959
							(Percent)				
Oklahoma City (1)	A	1	7.4	6.7	3.6	5.5	2.0	7.7	6.2	3.3	0.0
		2	33.8	41.7	56.4	54.5	38.8	33.3	40.6	53.3	53.3
		3	58.8	51.7	40.0	40.0	59.2	59.0	53.1	43.3	46.7
	B	1	14.3	17.6	2.9	17.1	24.3	11.1	13.0	11.9	11.4
		2	53.6	50.0	55.9	54.3	62.2	64.4	60.9	61.9	57.1
		3	32.1	32.4	41.2	28.6	13.5	24.4	26.1	26.2	31.4
	C	1	0.0	0.0	45.5	10.0	7.1	12.5	18.2	17.9	17.1
		2	100.0	100.0	27.3	60.0	64.3	56.2	50.0	60.7	68.6
		3	0.0	0.0	27.3	30.0	28.6	31.2	31.8	21.4	14.3
Tulsa (2)	A	1	3.1	2.9	0.0	4.5	4.2	5.9	4.5	0.0	5.0
		2	40.6	45.7	45.8	54.5	45.8	52.9	27.3	27.8	40.0
		3	56.3	51.4	54.2	40.9	50.0	41.2	68.2	72.2	55.0
	B	1	12.5	16.2	4.7	13.6	20.5	14.0	8.1	7.7	9.7
		2	57.5	59.5	60.5	52.3	46.2	44.2	40.5	51.3	45.2
		3	30.0	24.3	34.9	34.1	33.3	41.9	51.4	41.0	45.2
	C	1	12.5	6.2	23.8	18.2	8.0	17.9	17.2	9.7	13.5
		2	56.2	81.2	52.4	68.2	72.0	50.0	62.1	80.6	56.8
		3	31.3	12.6	23.8	13.6	20.0	32.1	20.7	9.7	29.7

For the size A producers in the Tulsa market, there was only a slight increase in the percentage of magnitude 1 producers with the percentage of magnitude 2 and magnitude 3 producers remaining about the same. There is little evidence based on the relative number of producers that appreciable adjustments in magnitude were made by small size producers in the Tulsa market. Some net decrease in magnitude may have occurred in the Oklahoma City market.

For the size B producers in the Oklahoma City market, there was some fluctuation in the percentage distribution of producer magnitudes from year to year, but the percentage distribution in 1959 was about the same as in 1951. In general, a net increase in the percentage of magnitude 2 producers appears to have occurred at the expense of both magnitude 1 and magnitude 3 producers. In the Tulsa market, size B producers tended to move toward more unstable production with a large increase in the percentage of magnitude 3 producers and a substantial decrease in the percentages of both magnitude 1 and magnitude 2 producers.

For the size C producers in the Oklahoma City market, there was little net movement toward more stable production. There was a decreasing percentage of magnitude 2 producers, with an increase in both the percentage of magnitude 1 producers and the percentage of magnitude 3 producers. However, the number of producers classified as size C was quite small, and the variation in percentages was quite large. In the Tulsa market for the size C producers, there was little movement either toward or away from more stable production. There was a slight increase in the percentage of magnitude 1 producers and a slight decrease in the percentage of magnitude 3 producers. The percentage of magnitude 2

producers remained about the same during the nine-year period.

The general tendency for producers to decrease magnitude in both markets from 1951 to 1959 appears to be related directly to the change in size of producers. At the end of the period, there were greater percentages of the large size producers which were stable or intermediate in terms of magnitude of seasonal fluctuation of production. This suggests that an increase in size is the primary reason for the movement toward more stable seasonal production patterns.

Changes in the Seasonal Patterns of Production

The relative number or percentage of producers of a given size in a given market in a given year with highs in production during each season was tabulated as was the percentage with lows in each season. Trends were calculated for changes in those percentages over time. The basic data utilized in estimating the percentages and trends are given in Appendix Tables I, II, III, and IV. The estimated regression coefficients (b values) and the corresponding standard errors (S_b) are included in Table X.

Size A Producers.--There is no statistically significant evidence of changes in seasonal highs of size A producers in either the Oklahoma City or the Tulsa milkshed. However, the percentage of producers with high production in the spring months tended to decrease, and the percentage with high production in the fall months tended to increase. This is consistent with trends in the daily average deliveries for the total market. The percentage of producers with high production in the winter months increased in Tulsa, but decreased in Oklahoma City.

TABLE X

ESTIMATED REGRESSION COEFFICIENTS AND STANDARD ERRORS FOR TRENDS IN THE PERCENTAGE OF PRODUCERS WITH HIGHS AND LOWS IN SPECIFIED SEASONS, TOTAL SAMPLE, 1951-1959

Market	Size Group	Values Estimated	Patterns: High Winter (1)	High Spring (2)	High Summer (3)	High Fall (4)	Low Winter (1)	Low Spring (2)	Low Summer (3)	Low Fall (4)
Oklahoma City (1)	A	b	-0.880	-0.405	0.048	0.151	0.077	1.208**	-0.443	-1.293
		s_b	0.481	0.198	0.847	0.724	0.878	0.187	0.671	1.105
	B	b	-0.165	-0.520	-0.135	1.775*	2.510*	0.115	-1.440	-1.792*
		s_b	0.866	0.672	1.052	0.747	1.001	0.452	0.883	0.578
	C	b	-4.513	-1.400	0.332	3.900**	2.158*	1.622	-1.595	-0.793
		s_b	2.770	0.720	1.184	0.998	0.638	0.924	2.392	1.063
Tulsa (2)	A	b	1.297	-2.428	0.233	0.548	-1.117	-0.238	0.745	-1.443
		s_b	0.620	1.688	2.284	1.043	1.599	0.587	2.157	1.554
	B	b	0.558	-1.343	-0.928	1.422*	-1.572	1.027	2.542*	-1.800*
		s_b	0.533	1.039	1.125	0.434	1.307	0.653	0.985	0.586
	C	b	1.033	-1.918	-0.875	2.355*	-2.482	0.590	0.492	0.768
		s_b	1.430	1.148	1.201	0.929	-1.527	0.321	2.222	0.852

*Statistically significant at the 5 per cent probability level.

**Statistically significant at the 1 per cent probability level.

With respect to seasonal lows, there was an increase in the percentage of producers with lows in the spring months and a decrease in the percentage with lows in the fall months for both markets. However, only the trend for Oklahoma City of an increasing percentage of producers with lows in the spring months is statistically significant.

Size B Producers.--There was a trend toward a larger percentage of size B producers with highs in the fall months in both markets. The regression coefficients are statistically significant at the 5 per cent probability level. The increase in Oklahoma City appears to represent some shift from all other patterns, but may have been primarily a shift from highs during the winter months. The increase in Tulsa appears to represent a shift from the spring and summer seasons only. The percentage of producers in Tulsa with a seasonal high in the winter months actually increased.

There was a statistically significant trend toward smaller percentages of size B producers with lows in the fall months in both markets. In Oklahoma City, there was also a decrease in the percentage with lows in the summer and an increase in the percentage with lows in the winter months. On the other hand, the percentage of producers with lows during the summer months in Tulsa increased while the percentage with lows during the winter months decreased.

Size C Producers.--Trends for size C producers were similar to those for size B producers. The trend toward a larger percentage of producers with highs in the fall months increased in both markets, and the trends were statistically significant. Some decrease occurred in the percentages with highs in the spring months in both markets. In the winter months, the regression coefficient was negative for Oklahoma

City and positive for Tulsa, indicating opposite trends during this season of the year for the two markets.

Trends in percentages of size C producers with lows during the various seasons of the year for Oklahoma City were not consistent with trends for Tulsa. There was a statistically significant increase in the percentage of Oklahoma City producers with lows during the winter months. The trend was negative and not statistically significant for Tulsa. A slight increase in the percentage of producers with lows during the spring months may have occurred in both markets. With respect to the percentage of producers with lows during the summer and fall seasons, a slight decrease is indicated for Oklahoma City while a slight increase is noted for Tulsa.

In summary, the adjustments in seasonal patterns by producers include a significant increase in the percentage of producers exhibiting a fall-high pattern in both markets, especially by the producers with larger volumes of milk sales. This adjustment represents a shift away from a high during the spring months in Tulsa and away from a high during the winter months in Oklahoma City.

As producers in both markets adjusted significantly toward a fall-high pattern, there was also a significant adjustment in seasonal lows. Relatively fewer producers had a low during the fall months. Small size producers in Oklahoma City shifted to a spring-low and the medium and large size producers shifted to a winter-low pattern. In the Tulsa market, the medium size producers shifted to a summer-low pattern. There is some evidence of a shift away from a seasonal low in the fall months by producers of smaller and larger sizes, but the trends were not significant, and there was no appreciable trend in

increasing numbers during other seasons.

Changes in Patterns During Selected Time Periods

The distribution of the total number of producers exhibiting six selected basic patterns during each year in each market are shown in Table XI. Changes in these numbers from 1951 through 1959 indicate a relative decline in the number of producers with the spring high-fall low pattern, the winter-high pattern, and, to some extent, the summer-high pattern. Large increases are indicated for the number of producers with both the fall-high and the level pattern of production.

TABLE XI

NUMBER OF PRODUCERS CLASSIFIED BY BASIC PATTERNS, OKLAHOMA CITY AND TULSA MILKSHEDS, 1951-1959

Patterns	Market	1951	1952	1953	1954	1955	1956	1957	1958	1959
Spring High-Fall Low	1	23	17	15	15	16	12	12	8	5
	2	18	14	15	10	14	8	7	10	13
	1&2	41	31	30	25	30	20	19	18	18
Spring High-Nonfall Low	1	13	22	18	18	16	27	12	16	18
	2	13	36	27	26	23	27	20	19	15
	1&2	26	58	45	44	39	54	32	35	33
Summer-High	1	22	19	25	12	11	14	11	18	26
	2	36	16	11	5	8	6	16	17	19
	1&2	58	35	36	17	19	20	27	35	45
Fall-High	1	5	6	9	14	11	20	19	26	18
	2	6	3	8	9	9	14	13	22	8
	1&2	11	9	17	23	20	34	32	48	26
Winter-High	1	18	16	14	15	19	9	23	11	5
	2	4	3	8	11	11	12	16	6	10
	1&2	22	19	22	26	30	21	39	17	15
No-High	1	19	20	19	26	27	18	23	21	28
	2	11	16	19	27	23	21	16	14	23
	1&2	30	36	38	53	50	39	39	35	51

Changes in the total number of producers with a given pattern do not necessarily indicate uniform adjustments by all producers. Potentially, each producer with a given pattern in a given year could have a different pattern in each subsequent year. Consequently, a tabulation was made which indicated for the group of producers with each pattern in 1951, the distribution of patterns adopted by those producers in 1954. A similar tabulation was made for each pattern existing in 1955 and the final pattern evident for 1959. These tabulations are included in Tables XII and XIII. The reason for separating the 1951-1959 period into two periods is the difference in pricing patterns utilized.[4]

Spring High-Fall Low Pattern

1951 to 1954 Adjustments.--From 1951 to 1954, over one-half the producers switched the season in which high production occurred and more than three-fourths switched the season in which low production occurred. Less than 20 per cent of the producers with this pattern in 1951 maintained the same pattern and magnitude in 1954. About 40 per cent of the producers decreased the magnitude of seasonal variation in production.

Of the producers adjusting seasonal high production patterns, approximately one-half changed to a pattern with no-high and approximately one-third moved to either a summer-high or a winter-high pattern. Apparently, the adjustments by producers from 1951 to 1954 in the two

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[4]See page 12.

TABLE XII

ADJUSTMENTS IN SEASONAL VARIATION FOR PRODUCERS WITH PATTERNS CLASSIFIED AS SPRING- OR SUMMER-HIGH
1951 to 1954 AND 1955 to 1959

Pattern	Time Period	Market	Maintainence of Pattern & Magnitude	Change in Magnitude		Change in Seasonal Highs						Change in Seasonal Lows
							Adjustment to Seasons[a]					
				Total	Adjustment to Lower Magnitude	Total	1	2	3	4	6	Total
				(Percent)								
Spring High-Fall Low												
	1951-1954	1	17	57	75	57	--	---	31	--	46	74
		2	16	22	77	50	33	--	--	--	56	83
		1+2	17	41	78	54	23	--	23	--	50	78
	1955-1959	1	6	62	81	81	--	--	38	23	--	88
		2	14	57	88	43	--	--	33	--	50	57
		1+2	10	60	83	63	--	--	37	--	26	73
Spring High-Nonfall Low												
	1951-1954	1	0	39	79	85	--	--	27	--	45	77
		2	23	45	80	31	25	--	--	--	75	69
		1+2	12	42	79	58	20	--	20	--	53	73
	1955-1959	1	13	44	86	69	--	--	45	--	36	56
		2	0	39	67	70	--	--	44	--	25	78
		1+2	5	41	76	69	--	--	44	--	30	69
Summer-High												
	1951-1954	1	5	32	72	86	--	53	--	--	32	68
		2	3	53	79	92	--	48	--	--	33	81
		1+2	3	45	76	90	--	50	--	--	33	76
	1955-1959	1	0	55	65	73	--	38	--	25	38	82
		2	13	75	33	63	--	60	--	--	40	38
		1+2	5	63	51	68	--	46	--	--	38	63

[a] Only major changes are reported.

TABLE XIII

ADJUSTMENTS IN SEASONAL VARIATION BY PRODUCERS WITH PATTERNS CLASSIFIED AS WINTER-, FALL-, AND NO-HIGH, 1951 to 1954 and 1955 to 1959

Pattern	Time Period	Market	Maintainence of Pattern & Magnitude	Change in Magnitude		Change in Seasonal Highs						Change in Seasonal Lows
				Total	Adjustment to Lower Magnitude	Total	Adjustment to Seasons[a] 1	2	3	4	6	Total
						(Percent)						
Fall-High												
	1951-1954	1	0	20	100	60	--	33	--	--	67	100
		2	0	67	50	83	20	20	--	--	60	67
		1+2	0	45	60	73	--	25	--	--	63	82
	1955-1959	1	9	36	100	82	--	22	22	--	44	73
		2	0	44	75	78	--	43	--	--	29	56
		1+2	5	40	88	80	--	31	--	--	38	65
Winter-High												
	1951-1954	1	6	59	69	71	--	42	--	33	25	65
		2	0	50	50	75	--	--	33	33	33	75
		1+2	5	57	67	71	--	33	--	33	27	67
	1955-1959	1	11	11	100	89	--	25	31	--	25	56
		2	9	73	37	73	--	--	25	38	38	55
		1+2	10	34	50	83	--	--	29	25	29	55
No-High												
	1951-1954	1	15	40	12	75	33	33	--	20	--	75
		2	18	64	0	64	43	--	--	43	--	73
		1+2	16	48	6	71	36	27	--	27	--	74
	1955-1959	1	25	54	7	68	--	32	32	37	--	68
		2	9	65	14	61	--	50	29	--	--	78
		1+2	18	59	12	65	--	42	32	26	--	73

[a] Only major changes are reported.

markets were similar except for the relative numbers of producers adjusting magnitudes. Over 50 per cent in Oklahoma City, but only about 20 per cent in Tulsa, adjusted the magnitude of seasonal variation.

1955 to 1959 Adjustments.--There was a continued and very noticeable decline from 1955 to 1959 in absolute numbers of producers with the spring high-fall low pattern in the Oklahoma City market. The decline was much less in the Tulsa market. Fewer than one-sixth of the producers with the spring high-fall low pattern in 1955 maintained the same pattern and magnitude in 1959. About 60 per cent of the producers in each market adjusted the magnitude of seasonal variation. Of these, about 83 per cent decreased the magnitude.

Four out of five producers in Oklahoma City changed the seasonal-high pattern, but only about two out of five producers in Tulsa made this same change. Of those producers changing seasonal-high patterns in Oklahoma City, the major move was to a summer-high pattern. In Tulsa, some producers also changed to a summer-high, but over 50 per cent adjusted to a pattern with no seasonal high. About 57 per cent of the producers in Tulsa and about 88 per cent in Oklahoma City adjusted production patterns away from a low during the fall season.

From 1955 to 1959 the adjustments in magnitude of seasonal variation by producers with this pattern in the two markets were comparable, but the percentage of producers adjusting away from this pattern was about twice as great in the Oklahoma City as in the Tulsa market. There was a greater adjustment to a pattern with no seasonal high in the Tulsa market than in the Oklahoma City market.

Spring High-Non Fall Low Pattern

1951 to 1954 Adjustments.--Exactly the same number of producers exhibited the spring high-non fall low pattern in 1951 in each market, but this number was relatively small compared with the number of producers having other patterns. By 1954, a substantial increase in numbers was evident for this pattern. The increase came almost exclusively from producers with another pattern type in 1951, since no producer in Oklahoma City and only about one-fourth of the producers in Tulsa maintained the same pattern and magnitude through out the period. About 40 per cent of the producers in each market adjusted magnitude, and of these, four out of five decreased the magnitude of seasonal variation in production.

About 85 per cent of the producers in Oklahoma City changed the seasonal-high pattern, but less than one-third of the producers in Tulsa made this same adjustment. The major shifts in both markets were to the pattern with no seasonal high in production. Most producers also changed production patterns in such a way that the seasonal low occurred during a different season in 1954 than in 1951.

1955 to 1959 Adjustments.--About one-half more producers in Tulsa than in Oklahoma City had a spring high-non fall low seasonal production pattern in 1955. By 1959 there was no real change in total numbers in Oklahoma City with this pattern type, but a substantial decrease had occurred in Tulsa. Less than one out of five producers in Oklahoma City and none in Tulsa maintained the same pattern and magnitude in 1959 as in 1955. Only about 40 per cent of the producers in each market adjusted magnitude by 1959, but two-thirds or more of these became more stable producers.

About 70 per cent of the producers in each of the markets switched the season of high production with almost one-half moving to a summer-high pattern. There was also a substantial adjustment to a pattern with no seasonal high in each market. The adjustment in seasonal lows was much greater in Tulsa, but more than one-half of the producers in each market made this adjustment.

Summer-High Pattern

1951 to 1954 Adjustments.--The total number of summer-high pattern producers relative to the total number of producers in each market indicated that this was a very important pattern in 1951. A significant decrease in total numbers occurred in each market by 1954. Virtually no producers in either the Tulsa or Oklahoma City markets maintained the summer-high pattern from 1951 to 1954. Less than one-half the producers changed the magnitude of seasonal variation, but over 70 per cent of these had smaller magnitudes of seasonal variations in production.

Approximately nine out of ten producers in each of the markets with the summer-high pattern in 1951 changed this pattern by 1954. The major move was to a spring-high pattern, indicating considerable potential for shifts between adjacent seasons depending on weather conditions and other factors. More than 70 per cent of the producers had lows in a different season in 1954 than in 1951.

1955 to 1959 Adjustments.--The number of producers with the summer-high pattern in 1955 was largest for Oklahoma City, although numbers were relatively small in each market. By 1959, there was a very significant increase in total numbers in each of the markets. Few individual producers, none in Oklahoma City and less than 20 per cent in Tulsa,

maintained the same pattern and magnitude in 1959 as in 1955. From one-half to three-fourths of the producers changed the magnitude of seasonal variation from 1955 to 1959. Of those producers adjusting magnitude, 65 per cent in Oklahoma City and 33 per cent in Tulsa decreased it.

The majority of the producers in both markets adjusted the season in which the highest production occurred. The major movement was to a spring-high, but some producers also moved to a pattern with no seasonal high. More than four out of five producers in Oklahoma City switched the season of the year in which production was lowest while only about one out of three producers in Tulsa made this same adjustment.

Fall-High Pattern

1951 to 1954 Adjustments.--The number of producers maintaining a fall-high pattern in 1951 was relatively small in each market. By 1954, numbers increased markedly in Oklahoma City over what they were in 1951. No producer in either market with this pattern in 1951 maintained the same pattern and magnitude in 1954. The majority of producers maintained the same magnitude of seasonal variation in 1954 as in 1951, but there was some adjustment toward greater stability in each market.

Most of the producers in each market changed the season for highest monthly production in 1954 as compared with 1951. The most significant movement was to a pattern with no seasonal highs. At least three out of five of the producers adjusting the seasonal-high pattern moved to a pattern with no high. There was also some movement back toward a spring-high pattern in each market. Most of the producers in both markets also changed the season in which the lowest monthly production occurred.

1955 to 1959 Adjustments.--From 1955 to 1958 there was a continued increase in the total number of producers with a fall-high pattern; in

each market the total numbers doubled. However, total numbers dropped sharply in 1959 as compared with 1958. In 1959 as compared with 1955, virtually no producers maintained the same pattern and magnitude. About one-third of the producers adjusted the magnitude of seasonal variation, and the majority of these decreased the magnitude.

About four out of five producers in each market shifted the seasonal high pattern from 1955 to 1959. The majority of producers moved to a seasonal pattern with no high or to a summer-high. Most of the producers also adjusted their timing of seasonal low production.

Winter-High Pattern

1951 to 1954 Adjustments.--The number of producers in the Tulsa market with seasonal highs in production during the winter months in 1951 was quite small. There was a significant percentage increase in the number of winter-high pattern producers in the Tulsa market by 1954, but the absolute number was little more than one-half as large as in the Oklahoma City market. Very few producers in either market maintained the same pattern and magnitude in 1954 as in 1951. Approximately one-half of the producers changed the magnitude of seasonal variation. Of those producers adjusting magnitude, at least 50 per cent decreased the magnitude of seasonal variation in production.

About three-fourths of the producers adjusted the season of highest production. The major changes in Oklahoma City were toward either a spring-high or a no-high pattern. Of those producers adjusting in Tulsa, the major changes were toward the summer-high, fall-high, and no-high patterns. Most producers also adjusted the timing of the seasonal low in production.

1955 to 1959 Adjustments.--From 1955 through 1959 there was a substantial decrease in the number of producers with a winter-high pattern, but most of the decrease occurred in the Oklahoma City market. Of all producers with this pattern in 1955, only about one out of ten maintained the same pattern and magnitude in 1959. There was little adjustment in magnitude by producers in the Oklahoma City market. About 75 per cent of the producers in the Tulsa market adjusted magnitude, and most of them increased the magnitude of seasonal variation.

A large percentage of the producers in both markets adjusted the pattern of seasonal highs. Producers shifted to spring-high, summer-high, and no-high patterns in the Oklahoma City market and to summer-high, fall-high and no-high patterns in the Tulsa market. More than one-half of the producers with a winter-high pattern also adjusted the season in which the lowest monthly production occurred.

No-High Pattern

1951 to 1954 Adjustments.--There was twice as many producers with a no-high pattern in Oklahoma City as in Tulsa in 1951. From 1951 through 1954, numbers increased in each market. Approximately 15 per cent of the producers in each market maintained the same pattern and magnitude in 1954 as in 1951. Approximately one-half of these producers changed the magnitude of seasonal variation by 1954; they increased the magnitude of seasonal variation.

More than one-half of the producers switched the seasonal high pattern. The major moves in Oklahoma City were to winter- and spring-high patterns. In Tulsa, the major adjustments were to winter- and fall-high patterns. Almost 75 per cent of the no-high pattern producers in each

of the markets also adjusted the seasonal low pattern of production.

1955 to 1959 Adjustments.--There was a relatively stable number of producers with a no-high pattern from 1955 to 1959 in each of the two markets. Only one out of five producers in Oklahoma City and virtually no producers in Tulsa with this pattern in 1955 maintained the same pattern and magnitude in 1959.

More than 60 per cent of the producers in each market switched from a no-high to a seasonal high pattern. However, uniform adjustments were not made in either market. In Oklahoma City, producers with a no-high pattern in 1955 switched to patterns with highs in the spring, summer, and fall. In Tulsa only changes to the spring- and summer-high patterns were evident. With the adjustment to a seasonal high, most producers also adjusted to a seasonal low pattern of production.

Summary of Adjustments by Sample Producers

The average seasonal variation in production for the sample of producers conceals much of the variability at the individual producer level. In 1951, producers in the Oklahoma City area generally were smaller than in the Tulsa area. By 1959, producers in both areas substantially increased milk deliveries, and the differential in size between the two milksheds narrowed. Analysis of changes in magnitude of seasonal variation of production indicates that much of the increase in stability appears to relate directly to this growth in size of producers. Analysis of changes in the pattern of seasonal variation in production indicates that a net movement away from seasonal highs during the spring season and toward a non-high or a fall-high pattern has occurred.

Analysis of changes in patterns of seasonal variation for producers with selected patterns in 1951 and in 1955 reveals an almost random change in patterns from one year to the next. Few producers maintained the same magnitude and pattern from one year to the next. There was, however, some tendency for movement away from the spring high-fall low pattern to a no-high or a fall-high pattern. There was also a net movement away from a pattern with lows in the fall. The greatest probability for change was to an immediately preceding or succeeding season. This was particularly true for changes between the spring- and summer-high patterns, and may have resulted primarily from the variability in weather which reflects, in part, variability in the quantity and quality of roughage supplied by pasture.

CHAPTER IV

VARIABILITY IN SEASONAL PRODUCTION PATTERNS FOR INDIVIDUAL PRODUCERS

Analysis of variance techniques are used to establish differences in the percentage of average production for each month for the producers included in the sample. Differences among producers are postulated to result from the city or location of the milkshed, the size of the dairy enterprise, the pattern-type classification of the producer, and the year of production. Grouping of producers into typical groups was based on the results from this analysis.

Analysis of variance, according to Snedecor(4, p. 239), is "a partitioning of degrees of freedom and corresponding sums of squares." In a heirarchal classification, which is the design selected for this study, the immediate objective is the separation of sums of squares due to the sources of variation. The hypothesized sources of variation in this study are: (1) city or market, (2) producer size within city, (3) producer seasonal pattern within size within city, and (4) year within pattern within size within city. The mathematical model used is $X_{ijklm} = \mu + A_i + B_{ij} + C_{ijk} + D_{ijkl} + \epsilon_{ijklm}$ where

X = observed monthly production as a percentage of the 12-month moving average
μ = average production
A = city
B = size
C = pattern
D = year
ϵ = error

and $i = 1, 2$; $j = 1 \ldots 9$, $k = 1 \ldots 21$, $l = 1 \ldots 9$, and $m = 1 \ldots n$. This model is explained by Pulley (10, p. 3).

It is assumed in the analysis of variance that $A_i = N(0, \sigma_A)$, $B_{ij} = N(0, \sigma_B)$, $C_{ijk} = (0, \sigma_C)$, $D_{ijkl} = N(0, \sigma_D)$ and $\epsilon_{ijklm} = N(0, \sigma_E)$.

Null hypotheses tested using the variance ratio test were the following: (1) $\sigma_A^2 = 0$, (2) $\sigma_B^2 = 0$, (3) $\sigma_C^2 = 0$, (4) $\sigma_D^2 = 0$. The variance ratio test is also explained by Snedecor (4, pp. 244-245).

If the F-test of the various components of variance, city, size, etc. is significant for each component tested, then the conclusion normally reached is that production varies from city to city, pattern to pattern, size to size, and year to year. If the F-test of a component is not significant, then the conclusion normally reached is that the component tested is not a significant contributor to the explanation of the total variance of production. In other words, the effect on the total amount of variance due to the component tested is negligible. If the effect of a component is negligible then it may be concluded that the variation explained by that component is only that which may be expected in sampling from a single normal population. The comparisons used for establishing statistical significance are as follows: (1) if the calculated F is $< F_{.05}$ then the empirical F value is not significant, (2) if $F_{.05} \leq$ F cal. $< F_{.01}$ then the empirical F value is significant, and (3) if $F_{.01} \leq$ F cal. then the empirical F value is highly significant. The theoretical values of F for convenient combinations of degrees of freedom for the 5 per cent and 1 per cent probability levels may be found in Snedecor (4, pp. 246-249).

Combined Markets

Analysis of variance techniques were applied to the Oklahoma City and Tulsa markets combined. The markets were combined in order that the hypothesized source of variation, market or city, could be tested for significance. The results of these tests are included in Table XIV. The tests indicate that city was usually a significant contributor to the total variance. The F-test for city was statistically significant for ten months. In eight of the months the F values were highly significant. Differences between cities were not indicated for the months of June and August. The test of the producer size component of variance was significant for each of the twelve months, eleven at the 1 per cent and one at the 5 per cent probability level. The F-test of the pattern component of variance indicated that pattern was highly significant for each month. Generally, the test for differences between years was inconclusive since only during six months of the year were differences between years indicated.

Three conclusions are reached from this analysis. First, city is a significant contributor to total variance during certain months. Therefore, the two markets, Oklahoma City and Tulsa, cannot be combined for all comparisons but must be kept separate in further analyses. Second, the tests of size and pattern indicate that both are highly significant components of total variance. This implies that there does exist a highly significant amount of variation in the percentage of average production for the different production patterns within different sizes and between different sizes within the two markets. The two components of variance, size and pattern, cannot be ignored in further considerations. Third, the component of variance, year, may not be a

TABLE XIV

F-TEST VALUES OF SELECTED COMPONENTS OF VARIANCE, COMBINED MARKETS IN OKLAHOMA, 1951-1959

Component Tested	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
City	15.27**	51.08**	26.15**	6.86**	66.29**	1.22	5.18*	1.49	26.25**	13.86**	7.10*	5.62*
Size	12.31**	10.70**	6.77**	3.65**	18.43**	17.25**	14.86**	15.58**	2.93*	12.44**	23.27**	16.40**
Pattern	5.47**	6.97**	4.75**	4.95**	8.58**	5.53**	7.04**	11.36**	4.88**	5.56**	8.55**	4.92**
Year	1.11	1.18**	1.01	1.09	1.11	1.09	1.21**	1.14*	1.19**	1.19**	1.02	1.16*

*Empirical "F value" significant at the 5 per cent level.

**Empirical "F value" significant at the 1 per cent level.

significant contributor to the explanation of total variance except during the summer. Thus, the possibility exists for combining the nine individual years of data within each market.

Individual Markets

Analysis of variance techniques were also used for the separate markets. This was done in order to determine if pattern, size, and year are significant in explaining variation in production within each market. The results of the tests of components of variance for the Oklahoma City market are contained in Table XV.

For the Oklahoma City market, the F-tests indicate that size was statistically significant for each month. The F values are significant at the 1 per cent level of probability for eleven months and at the 5 per cent level for one month. Differences in patterns were highly significant in each of the twelve months. As in the combined markets, differences between years were not statistically significant except in selected months and these were not always the same for both markets. These tests of significance indicate that monthly production as a percentage of annual production varies from pattern to pattern and from size to size, but may not vary consistently from year to year.

The empirical F values for the Tulsa market analyses of variance are also included in Table XV. Size as a component of the total variance in the Tulsa market was highly significant in all months except September. Pattern differences were highly significant in each month, but year differences were statistically significant only for the four months of January, March, April, and August.

Generally, the results for each city were about the same as for the combined markets. The only major differences were the months where

TABLE XV

F-TEST VALUES OF SELECTED COMPONENTS OF VARIANCE, OKLAHOMA CITY AND TULSA MARKETS, 1951-1959

Component Tested	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
						Oklahoma City Market						
Size	9.14**	4.39**	2.53*	2.82**	27.82**	19.00**	8.69**	9.84**	3.12**	18.26**	34.76**	16.35**
Pattern	6.28**	7.54**	4.65**	5.09**	9.77**	6.24**	7.47**	12.04**	5.46**	6.00**	10.82**	5.72**
Year	1.01	1.27*	1.12	1.02	1.06	1.06	1.23*	1.05	1.22*	1.24*	1.24*	1.21*
						Tulsa Market						
Size	15.96**	18.82**	13.16**	4.54**	10.09**	15.50**	21.44**	21.23**	1.06	5.98**	13.86**	16.51**
Pattern	4.73**	6.56**	5.18**	4.85**	7.47**	4.86**	6.68**	10.73**	4.35**	5.26**	6.67**	4.19**
Year	1.29*	1.06	1.23*	1.24*	1.16	1.12	1.20	1.25*	1.16	1.14	1.12	1.10

*Empirical F significant at the 5 per cent level.

**Empirical F significant at the 1 per cent level.

differences were indicated. In Oklahoma City, differences between years were indicated principally for the last half of the year. In Tulsa, on the other hand, differences between years were indicated mainly for the first half of the year.

Selected Patterns

Certain basic producer pattern types were selected for further analysis. These patterns were selected from among the original 21 possible patterns for each of the three different magnitude classifications. They are (1) spring high-fall low, (2) spring high-non fall low, (3) winter-high, (4) summer-high, (5) fall-high, and (6) level or no-high. The spring high-fall low and the spring high-non fall low patterns were selected for consideration due to the nature of the production seasonality problem mentioned earlier. The winter, summer, fall, and no-high patterns were selected to represent the remaining pattern types.

Analyses of variance were calculated for the six patterns in order to test the significance of size as a component of total variance for similar production patterns, aggregated over the nine-year period. The results are included in Table XVI. For the spring high-fall low pattern, the test of size as a component of variance was significant during the months of May and November for Oklahoma City, and during September for Tulsa. Therefore, within the spring high-fall low pattern, size is not an important factor in explaining variation in production expressed as a percentage of the moving average.

The same conclusion did not appear warranted for producers with the spring high-non fall low pattern. For this pattern, the test of size as a component of variance was highly significant in the Oklahoma City

TABLE XVI

F-TEST VALUES OF SELECTED COMPONENTS OF VARIANCE, BASIC PATTERNS IN OKLAHOMA MARKETS, 1951-1959

Pattern	City	Component Tested	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Spring High-Fall Low														
	1	Size	2.83	.22	.95	.72	7.57**	2.57	.73	.74	.54	.97	5.20**	2.30
	2	Size	.64	.42	.47	.06	1.57	.30	.74	2.17	4.92**	1.60	2.60	.26
Spring High-NonFall Low														
	1	Size	2.97	1.19	.15**	1.52	10.83**	7.42**	.44**	.16	2.23	5.71**	2.10*	.27**
	2	Size	12.16**	14.44**	8.73	.65	13.09**	16.10**	8.83**	1.34	.43	4.59*	3.84*	8.91**
Winter-High														
	1	Size	.21	1.99	1.06	1.54	1.14	.05	.07	1.93	1.38	.49	.50	.72
	2	Size	.75	.64	.50	.18	1.68	.73	1.04	.49	.62	3.79*	1.47	.52
Summer-High														
	1&2	City	.07	1.99	3.21	1.14	.07	1.32	.49	1.36**	14.05**	8.40**	.98	.98**
		Size	.15	1.64	3.19	3.02	.65	.18	1.72	6.79**	1.35	1.81	1.49	3.71**
Fall-High														
	1&2	City	2.08	1.73	.50	3.73	14.66*	2.57	.30	1.76	.13	.43	.17	.00
		Size	1.19	.63	.76	1.85	1.03	.38	1.65	.61	.39	1.22	.83	1.21
No-High														
	1&2	City	.00	1.72	6.13*	.80	5.44*	2.32	6.40*	2.18	4.20*	4.53*	3.84	.12
		Size	2.34	1.24	.53	2.70*	1.03	.85	1.26	1.65	1.55	1.12	4.34**	2.83*

*Empirical F significant at the 5 per cent level.

**Empirical F significant at the 1 per cent level.

market during the months of May, June, and October. In the Tulsa market the test of size was highly significant during the months of January, February, March, May, June, July and December and it was significant during the months of October and November. Evidence from these tests indicate that size is important and that producer sizes should not be aggregated in each market in the study of the spring high-non fall low patterns.

For the winter-high pattern, the test for size was not significant during any month of the year in the Oklahoma City market. For the Tulsa market the test for size was statistically significant only during the month of October. Therefore, sizes may be combined in each market for producers with seasonal high production in the winter months.

Both size and city differences were tested for the summer-high pattern. The test for differences between cities or markets was highly significant only during the months of September and October. During the other ten months, there was no basis for separation of the markets. With respect to size, the test was highly significant only during the months of August and December. There is little evidence to suggest that sizes and cities can not be aggregated within the summer-high pattern of seasonal variation in production.

For the fall-high pattern the city differences were statistically significant only during the month of May. The test of the difference in size was not statistically significant for any month. The conclusion reached is that producers having a fall-high pattern might be aggregated into one group, ignoring relative sizes of producers and the individual market.

For those producers exhibiting a no-high pattern of production, F-tests of city were significant during five months and the F-tests for

size were significant during three months, two at the 5 per cent probability level and one at the 1 per cent level. This evidence is inconclusive with respect to aggregation of producers into one group based on all sizes and both cities for this pattern.

The analyses of variance for the selected patterns indicate that producer size and the specific market may be ignored in most within-pattern groups. The primary exception is size within the spring high-non fall low pattern for the Tulsa market.

These results, plus the information gained from the previous analyses indicate that pattern is the most important factor in explaining differences among producers in the percentage of average production during a specific month of the season. In some instances, separate consideration should be given to the city and to the size of the producer for specific seasonal patterns of production.

Based on these tests, on the analyses explained in Chapter III, and on the results from plotting average seasonal patterns for various subclassifications, the average seasonal variation in production for each of 19 selected groups of producers was determined. The percentage of average production for each month and the standard deviation of the percentages are shown in Table XVII. In comparing the patterns for each of the groups, there is a tendency for small size producers to have greater seasonal variation than the medium and large size producers for each market. There is also a tendency for producers of a given size in the Tulsa milkshed to have greater seasonal variation than in the Oklahoma City milkshed for those patterns in which there were differences between the two milksheds.

TABLE XVII

SELECTED STATISTICS ON AVERAGE SEASONAL VARIATION OF PRODUCTION IN THE OKLAHOMA METROPOLITAN MILK MARKETING AREA, NINETEEN REPRESENTATIVE CLASSIFICATIONS, 1951-1959

Size	City	Value	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
			Percent of 12-Month Moving Average											
Spring High-Fall Low Pattern														
A	1,2	Mean	86.25	90.85	110.77	122.15	142.06	127.25	117.35	99.55	82.59	72.19	68.20	80.79
B,C		s^2	(16.85)	(14.62)	(18.75)	(20.51)	(16.31)	(18.88)	(17.80)	(16.48)	(17.72)	(16.98)	(13.88)	(17.41)
B,C	1	Mean	92.92	90.79	110.19	118.99	129.79	120.34	114.48	99.15	83.97	75.89	75.99	87.50
		s^2	(14.10)	(10.62)	(11.69)	(12.94)	(9.25)	(11.35)	(12.67)	(14.93)	(12.16)	(11.43)	(9.15)	(14.04)
B,C	2	Mean	89.12	85.43	105.48	119.90	136.80	124.28	118.00	105.02	91.49	77.86	69.08	77.54
		s^2	(13.24)	(11.68)	(13.80)	(15.52)	(12.78)	(16.34)	(16.82)	(13.19)	(15.07)	(18.09)	(14.25)	(12.69)
Spring High-Non Fall Low Pattern														
A	1	Mean	87.67	84.83	104.17	119.13	133.71	119.09	103.13	91.78	82.63	86.12	90.20	97.54
		s^2	(23.12)	(22.78)	(24.42)	(20.36)	(13.60)	(19.45)	(23.40)	(24.06)	(22.41)	(16.32)	(13.69)	(19.94)
A	2	Mean	80.58	75.96	95.39	117.61	142.16	125.26	110.19	94.31	88.83	90.24	89.32	90.15
		s^2	(18.87)	(18.85)	(22.95)	(21.51)	(21.20)	(22.26)	(21.12)	(24.17)	(22.49)	(15.08)	(16.70)	(19.22)
B,C	1	Mean	94.46	88.71	104.94	113.97	124.30	108.30	100.18	89.41	88.83	93.68	94.27	98.95
		s^2	(15.85)	(13.64)	(16.04)	(11.41)	(8.61)	(14.27)	(16.83)	(16.98)	(14.77)	(12.25)	(13.90)	(11.30)
B,C	2	Mean	91.56	87.85	106.48	118.56	128.30	107.10	94.66	87.37	90.19	95.40	93.88	98.65
		s^2	(15.45)	(14.84)	(18.01)	(15.80)	(11.49)	(17.29)	(21.90)	(21.09)	(17.20)	(13.55)	(12.55)	(14.53)
Summer High Pattern														
A	1	Mean	91.28	82.45	87.35	88.74	106.47	109.83	127.96	131.04	114.14	95.27	83.04	82.43
		s^2	(21.02)	(16.52)	(19.12)	(16.83)	(18.93)	(21.62)	(23.64)	(17.76)	(16.26)	(16.25)	(15.92)	(16.87)
A	2	Mean	89.99	74.75	77.19	82.61	105.89	106.62	129.86	139.39	124.69	103.25	84.92	80.84
		s^2	(19.37)	(18.29)	(21.53)	(18.93)	(22.48)	(25.91)	(25.54)	(21.18)	(20.21)	(19.84)	(18.11)	(19.18)
B,C	1,2	Mean	89.44	79.75	87.96	90.35	103.67	106.22	121.85	126.58	115.72	102.31	87.62	88.53
			(15.97)	(13.72)	(15.16)	(14.15)	(16.22)	(19.94)	(18.95)	(11.83)	(16.56)	(16.56)	(14.94)	(16.18)

TABLE XVII (Continued)

Size	City	Value	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
			Percent of 12-Month Moving Average											
Fall High Pattern														
A	1	Mean	109.45	98.87	104.54	98.93	97.01	80.52	71.82	74.75	96.89	121.64	121.68	123.90
		s^2	(17.53)	(14.13)	(16.12)	(19.97)	(19.64)	(19.03)	(25.53)	(27.16)	(29.60)	(24.23)	(17.47)	(20.94)
A	2	Mean	104.30	92.52	98.43	94.86	97.30	86.73	78.67	78.05	102.51	127.23	124.14	115.26
		s^2	(14.99)	(16.57)	(18.28)	(15.52)	(16.06)	(19.65)	(26.55)	(24.44)	(25.91)	(19.97)	(20.17)	(14.42)
B,C	1	Mean	110.84	97.19	105.30	99.39	94.31	79.46	76.60	79.74	98.36	120.00	119.73	119.08
		s^2	(16.51)	(12.15)	(14.14)	(15.23)	(17.27)	(16.42)	(21.32)	(25.93)	(20.13)	(20.03)	(9.50)	(15.14)
B,C	2	Mean	107.96	95.76	104.78	105.27	104.73	82.69	72.50	72.74	95.39	116.63	120.16	121.39
		s^2	(15.00)	(14.08)	(14.57)	(13.97)	(12.20)	(16.30)	(22.25)	(25.66)	(21.07)	(17.74)	(11.00)	(16.61)
Winter High Pattern														
A,B,C	1	Mean	122.73	114.90	123.73	109.45	102.45	85.50	82.71	77.17	80.71	91.71	99.62	109.32
		s^2	(18.08)	(11.72)	(15.52)	(15.03)	(14.57)	(16.30)	(21.80)	(22.47)	(20.02)	(19.76)	(18.65)	(20.40)
B,C	2	Mean	123.70	111.56	119.19	109.91	104.19	81.05	72.18	74.89	90.11	101.79	101.83	109.60
		s^2	(10.78)	(9.07)	(12.10)	(13.92)	(13.87)	(14.27)	(18.08)	(22.55)	(18.22)	(15.23)	(13.65)	(15.68)
No-High Pattern														
A	1	Mean	105.18	97.05	105.27	101.45	106.50	100.89	98.92	97.00	95.54	97.63	93.85	100.72
		s^2	(13.23)	(10.56)	(15.36)	(11.50)	(10.82)	(11.98)	(14.87)	(16.01)	(15.03)	(14.94)	(16.79)	(18.75)
A	2	Mean	98.31	93.12	101.93	101.23	108.06	99.91	100.27	98.95	103.97	103.42	93.10	97.73
		s^2	(12.81)	(10.82)	(9.23)	(10.52)	(14.22)	(17.85)	(13.32)	(12.68)	(18.19)	(15.98)	(13.97)	(13.22)
B,C	1,2	Mean	102.39	93.28	103.87	103.85	106.69	97.10	97.29	95.30	98.44	101.05	98.25	102.49
		s^2	(10.97)	(9.89)	(10.80)	(9.83)	(9.00)	(12.12)	(14.53)	(14.46)	(13.11)	(12.33)	(10.90)	(10.96)

CHAPTER V

ANALYSIS OF INCENTIVES TO CHANGE SEASONAL PRODUCTION PATTERNS UNDER THE ALTERNATIVE PRICING PLANS

An analysis of the probable effects of various selected pricing plans, and modifications thereof, on gross and net returns of producers having different seasonal patterns requires estimated prices of milk as well as estimated costs of production. The procedure for estimating costs is included in Chapter II. The definition of the plans and the estimated prices used are developed as each plan is introduced. The relative effectiveness of alternative pricing plans is determined on the basis of the relative economic incentive provided by each plan to producers for reducing the seasonal variation in production.

The primary standard of comparison used to judge the relative effectiveness of the alternative pricing plans in providing incentives to producers is returns above feed costs for a hypothetical producer who markets 100 per cent of his 12-month moving average production each month during the year. If the objective of the pricing plans considered is to stabilize seasonal production, the returns above feed costs of the "ideal" pattern producer would have to be the greatest possible under each plan. In succeeding sections of this study this standard of comparison will be referred to as potential, or potential income to the ideal pattern producer. The secondary standard of comparison is the ideal producer's return above feed costs under the

Uniform-Blend Plan.

Uniform-Blend Plan

The Uniform-Blend Plan used in this study is a plan under which producers may produce and market any amount of milk and receive the basic blend price established for the market for all milk marketed (11, pp. 154-156). The blend price received by producers is a weighted average of two prices, the Class I price and the Class II price. The Class I price is a formula-determined price (12, p. 5) paid for all milk utilized in selected fluid uses, primarily milk sold for consumption as fluid milk. The Class II price is the average of the basic field prices paid for all milk in excess of fluid milk requirements, primarily milk sold for manufacturing purposes. In this study, a 10-year average of the percentage of the 12-month moving averages for utilization as Class I milk was determined for each month. This pattern of seasonal variation was applied to an average Class I utilization of 78 per cent to obtain estimates of the average percentage of Class I utilization in each month. The Class II utilization is 100 per cent minus the Class I utilization percentage. The basic prices explained in Chapter II were used with these utilization percentages to obtain a Uniform-Blend price for each month as shown in Table XVIII.

The incentives as reflected in the relative returns above feed costs of producers for adjustment either toward or away from the more stable monthly production were quite small. They range from a very small addition of 1.3 and 2.0 cents per hundredweight of milk produced and marketed by summer-high pattern producers for maintaining the same or a similar pattern to a slight penalty of about 2.0 cents per hundredweight of milk marketed by winter-high producers for not adjusting

TABLE XVIII

PRICES UTILIZED FOR COMPUTATION OF TOTAL REVENUE UNDER ALTERNATIVE PRICING PLANS

Months	Prices for Original Plans				Prices for Modified Plans		
	Uniform	Base I	Base II	Excess	Uniform	Base I	Base II
	(Dollars Per Cwt.)						
January	5.17	5.17	5.40	3.23	5.17	5.17	5.40
February	5.10	5.25	5.34	3.21	5.10	5.25	5.34
March	4.99	5.19	5.28	3.18	4.99	5.19	5.28
April	4.82	5.07	5.20	3.13	4.53	4.74	4.84
May	4.63	4.93	5.05	3.11	4.37	4.61	4.71
June	4.69	4.94	4.95	3.11	4.41	4.61	4.62
July	4.79	5.06	4.96	3.12	4.79	5.06	4.96
August	4.87	4.87	5.02	3.13	4.87	4.87	5.02
September	5.04	5.04	5.26	3.19	5.04	5.04	5.26
October	5.12	5.12	5.33	3.17	5.12	5.12	5.33
November	5.16	5.16	5.35	3.21	5.16	5.16	5.35
December	5.11	5.11	5.34	3.22	5.11	5.11	5.34
Mean	4.958	5.076	5.207	3.168	4.888	4.994	5.121

toward a more level production pattern (Table XIX). Producers with a summer-high pattern of production all have larger returns above feed costs than the "ideal" producer under this pricing plan. During the months of the summer season, feed costs are somewhat lower because of the relative abundance of pasture. Also, the seasonality of concentrate feed prices is such that the price of concentrates is somewhat lower during the summer. It may be concluded that any incentive which exists under this plan is to move toward a seasonal high in the summer months and away from a seasonal high in the winter months. However, the incentives provided producers under the Uniform-Blend Plan are, in general, not significant enough to induce much adjustment either toward or away from more level seasonal production patterns.

If the assumption of a 30-cow herd is made and if it is also assumed that the "typical cow" produces 9,000 pounds of milk per production period,

TABLE XIX

UNIFORM BLEND: RETURNS ABOVE FEED COSTS RELATIVE TO TWO STANDARDS OF COMPARISON FOR SELECTED MARKET, PRODUCER SIZE, AND SEASONAL PATTERN CLASSIFICATIONS

City	Pattern Classification	Size	Uniform Blend Difference From Potential	Modified Uniform Blend Difference From Potential
			(Cents Per Cwt.)	
1 & 2	Spring High-Fall Low	A	-1.4	-3.4
1	Spring High-Fall Low	B & C	-1.1	-2.6
2	Spring High-Fall Low	B & C	-0.9	-2.7
1	Spring High-Nonfall Low	A	-1.0	-2.6
2	Spring High-Nonfall Low	A	-0.5	-2.4
1	Spring High-Nonfall Low	B & C	-0.9	-1.8
2	Spring High-Nonfall Low	B & C	-1.1	-2.2
1	Level (No High)	A	-0.4	-0.5
2	Level (No High)	A	-0.1	-0.2
1 & 2	Level (No High)	B & C	-0.3	-0.4
1	Winter High	A,B & C	-1.9	-1.7
2	Winter High	B & C	-1.7	-1.5
1	Summer High	A	1.3	1.3
2	Summer High	A	2.0	2.2
1 & 2	Summer High	B & C	1.3	1.4
1	Fall High	A	-0.5	0.1
2	Fall High	A	0.1	0.7
1	Fall High	B & C	-0.4	0.3
2	Fall High	B & C	-0.8	-0.5

then the incentive for summer-high pattern producers to maintain the same pattern would only be between $35.00 and $54.00 per year in increased returns above feed costs relative to the returns above feed costs of the "ideal" pattern producer under the Uniform-Blend Plan. Summer-high pattern producers would lose money if they shift toward a more level pattern. The penalty suffered by the winter-high pattern producers for not adjusting to a more level pattern would only be between $46.00 and $52.00 per year in terms of smaller returns above feed costs. These amounts for a 30-cow herd over an entire production period appear negligible.

The modified Uniform-Blend Plan as used in this study is the original Uniform-Blend Plan combined with a 40 cent per hundredweight decrease in the Class I price for milk marketed during the months of April, May, and June. Under this modified plan, there is a greater penalty involved for producers maintaining a spring-high pattern than under the original Uniform-Blend Plan. Producers with the spring-high pattern could increase their returns by 2 to 3 cents per cwt. by adopting a level pattern. They could increase their income by an additional 2 cents per cwt. by adjusting to a summer-high pattern. Other than for the summer-high pattern, the original and modified plans seem to be about the same in their ability to provide an incentive to producers great enough to stabilize production from one month to the next or to move to a summer-high pattern. Generally, the incentives under the Uniform-Blend Plan, both original and modified, to change patterns of seasonal variation in production are always small and in the same direction.

Base-Surplus Plan I

The Base-Surplus Plan I utilized in this study is assumed to have a base-setting period of September, October, November, and December. A similar plan is explained by Alexander and Ortego (13, pp. 4 and 5). The base-operating period is assumed to be the months of February, March, April, May, June, and July. The two months of January and August not included in either the base-forming or base-operating periods are defined as "open" months. During the base-forming and open months, producers receive the uniform or "blend" prices as calculated for the total market.

Under Base-Surplus Plan I, a producer may participate in Class I sales during the base-operating period only through the base. During this period, producers are paid on the basis of base and excess prices. The base price is a quantity weighted blend price of Class I and Class II prices which is different from that calculated for the Uniform-Blend Plan. To derive this base price for each month of the base-operating period as used in this study, estimates of the Class I and Class II utilization of base milk expressed as a percentage of the total quantity of base milk marketed during the base-setting period were derived for the period from 1951 through 1960. Averages of the percentages were computed for each month of the period. The summation of the products of (1) the monthly Class I price and the average per cent of base milk utilized as Class I and (2) the monthly Class II price and the average percentage of the base milk utilized as Class II yielded the monthly "blend" base prices for each of the months, February through July. These prices were used for base milk in the calculation of the various producer total revenues under Base-Surplus Plan I. For excess milk,

prices used are the Class II prices used in computing the base price.

Returns above feed costs for producers with various seasonal production patterns operating under Base-Surplus Plan I are included in Table XX. Relative to the "potential," there is a penalty involved for producers having other than a perfectly level pattern operating under Base-Surplus Plan I. The possibility of increasing returns above feed costs is greatest for producers with the spring high-fall low pattern, especially for the smaller size producers. These producers could obtain increased returns above feed costs of 30 to 40 cents per cwt. by adopting a level seasonal production pattern and could obtain almost this much by reversing the pattern such that the highest production occurred during the fall season.

Small-size producers with a spring high-non fall low pattern could increase returns by 20 cents per cwt. by adopting a perfectly level production pattern. There is also a substantial incentive of about 13 cents per cwt. for medium and large size producers exhibiting a spring high-non fall low pattern of production in either market to adjust their seasonality of production toward the "ideal" pattern. The same incentive exists for the winter-high group of producers in the Oklahoma City market. Producers exhibiting a winter-high pattern in the Tulsa market, and producers with summer-, fall-, and no-high production patterns in both markets are penalized between one and nine cents per hundredweight of milk marketed for not adjusting their seasonal pattern toward the "ideal" pattern.

These comparisons indicate that producers with a definite seasonal pattern of production are penalized for not adjusting seasonal patterns toward the "ideal" pattern under Base-Surplus Plan I. Assuming a 30-cow

TABLE XX

BASE-SURPLUS PLAN I: RETURNS ABOVE FEED COSTS RELATIVE TO THE TWO STANDARDS OF COMPARISON FOR SELECTED MARKET, PRODUCER SIZE, AND SEASONAL PATTERN CLASSIFICATIONS

City	Pattern Classification	Size	Base-Surplus Plan I Difference From:		Modified Base-Surplus Plan I Difference From:	
			Potential	Uniform	Potential	Uniform
			(Cents Per Cwt.)			
1 & 2	Spring High-Fall Low	A	-39.2	-27.4	-37.2	-26.6
1	Spring High-Fall Low	B & C	-30.8	-19.0	-29.2	-18.6
2	Spring High-Fall Low	B & C	-32.8	-21.0	-31.1	-20.5
1	Spring High-Nonfall Low	A	-20.4	- 8.6	-19.5	- 8.9
2	Spring High-Nonfall Low	A	-20.9	- 9.1	-20.0	- 9.4
1	Spring High-Nonfall Low	B & C	-12.7	- 0.9	-12.2	- 1.6
2	Spring High-Nonfall Low	B & C	-12.9	- 1.1	-12.4	- 1.8
1	Level (No High)	A	- 4.7	7.2	- 4.4	6.2
2	Level (No High)	A	- 2.0	9.8	- 1.9	8.7
1 & 2	Level (No High)	B & C	- 2.5	9.3	- 2.4	8.2
1	Winter High	A,B & C	-13.1	-1.3	-12.4	- 1.8
2	Winter High	B & C	- 8.8	3.0	- 8.3	2.3
1	Summer High	A	- 8.3	3.5	- 7.6	3.0
2	Summer High	A	- 5.6	6.2	- 5.0	5.6
1 & 2	Summer High	B & C	- 4.3	7.5	- 4.0	6.6
1	Fall High	A	- 1.6	10.3	- 0.9	9.7
2	Fall High	A	- 0.9	10.9	- 0.3	10.3
1	Fall High	B & C	- 1.4	10.4	- 0.7	9.9
2	Fall High	B & C	- 1.5	10.3	- 1.2	9.4

herd as typical in the milkshed, the incentives for spring-high pattern producers to eliminate seasonal variability of production would range from 340 to 1,060 dollars per year. This incentive is quite large.

The possibility of increasing returns above feed costs for each group of producers operating under the Modified Base-Surplus Plan I is about the same as under the original plan. However, the potential returns are not as large for any of the producers since average monthly prices are slightly lower under the modified plan.

The returns above feed costs of the various groups of producers operating under Base-Surplus Plan I, relative to the returns above feed costs of the "ideal" pattern producer operating under the Uniform-Blend Plan, are also included in Table XX. Comparison of the patterns indicate incentives to move to either a no-high or to a fall-high pattern. However, base prices average somewhat higher and annual prices average about 8 to 10 cents per cwt. higher under Base-Surplus Plan I than under the Uniform-Blend Plan. Consequently, positive net returns are shown for all except the patterns with seasonal high production during the spring months. The relationship between producer returns above feed costs for the various pattern types under the modified plans is much the same as under the original plans.

Louisville Type Plan

Under the Louisville Type Plan or "take off and pay back" plan (11, pp. 190-199), producers are paid a blend price during each month similar to that calculated for the Uniform-Blend Plan. However, during the flush production months a deduction is made from the price paid during these months. This money is paid back during the short production months as an amount in addition to the blend price. Usually the

amount deducted per hundredweight is less than the amount paid back because of differences in the quantity of milk delivered in the two seasons. The total amount of money transferred from one season to the next is approximately the same. In this study it is assumed that 40 cents per hundredweight is deducted from a producer's blend price during the months of April, May, June, and July. This deduction is assumed to be retained in a producer-reserve fund for distribution later by the Market Administrator. It is further assumed that during the months of September, October, November, and December, producers receive the blend price plus a "pay back" of 45 cents per hundredweight of milk marketed. This is the pricing plan considered in this study. The relative returns above feed costs for producers with the various size and pattern classifications operating under the Louisville Type Plan are included in Table XXI.

Incentives exist for some producers to change the pattern of seasonal variation in production. Relative to the potential of a perfectly level production pattern, returns range from a loss of nine cents to a gain of four cents per cwt. The largest incentive for adjustment of production seasonality toward no seasonality is an extra return above feed costs of nine cents per cwt. of milk for the small size spring high-fall low pattern producers. Under the 30 "typical cow" herd assumption this incentive is about 240 dollars per year. Producers with winter-, summer-, and no-high patterns would incur small losses under the Louisville Type Plan if they did not adjust toward the "ideal" pattern. Under the 30 "typical cow" herd assumption this penalty would range from 13 to 143 dollars per production period.

The fall-high pattern producers have greater returns above feed costs than the "ideal" pattern producer under the Louisville Type Plan.

TABLE XXI

LOUISVILLE TYPE PLAN: RETURNS ABOVE FEED COSTS RELATIVE TO THE TWO STANDARDS OF COMPARISON FOR SELECTED MARKET, PRODUCER SIZE, AND SEASONAL PATTERN CLASSIFICATIONS

City	Pattern Classification	Size	Difference From: Potential	Difference From: Uniform
			(Cents Per Cwt.)	
1 & 2	Spring & Fall	A	-8.6	-6.9
1	Spring & Fall	B & C	-6.8	-5.1
2	Spring & Fall	B & C	-7.4	-5.7
1	Spring & Nonfall	A	-5.2	-3.5
2	Spring & Nonfall	A	-5.3	-3.6
1	Spring & Nonfall	B & C	-3.3	-1.7
2	Spring & Nonfall	B & C	-3.5	-1.8
1	Level (No High)	A	-1.1	0.5
2	Level (No High)	A	-0.5	1.2
1 & 2	Level (No High)	B & C	-0.5	1.2
1	Winter High	A,B & C	-1.9	-0.2
2	Winter High	B & C	-0.5	1.2
1	Summer High	A	-0.8	0.9
2	Summer High	A	0.9	2.6
1 & 2	Summer High	B & C	0.3	2.0
1	Fall High	A	3.6	5.3
2	Fall High	A	4.1	5.8
1	Fall High	B & C	3.4	5.1
2	Fall High	B & C	2.4	4.1

Therefore, an economic incentive exists for producers having the fall-high pattern to maintain this seasonal pattern of production and for producers with other patterns to adjust to this pattern. For the medium and large size spring high-fall low pattern producers, the incentive ranges from 11 to 12 cents per hundredweight to move toward a fall-high pattern. The incentive is largest for the small size producers with this pattern.

Relative to the second standard of comparison, prices apparently average slightly higher under the Louisville Type Plan than under the Uniform-Blend Plan. Gains to producers with a fall-high pattern are slightly greater and the penalties to producers with a spring-high pattern are slightly smaller than for a perfectly level pattern.

In summary, the Louisville Type Plan would not provide large incentives in terms of extra returns over feed costs for adjustments toward a perfectly level seasonal production pattern. The incentives for such adjustments are only about one-fourth as large as under Base-Surplus Plan I. However, this plan would have the advantage of transmitting an incentive directly through the pricing mechanism for smaller production during the spring months and for larger production during the fall months. The magnitude of adjustments likely to occur do appear small unless the "take off" and "pay back" payments are substantially larger than those used in this study.

Base-Surplus Plan II

Base-Surplus Plan II is defined as a pricing plan under which producers establish a base during the 12 months of January through December, with the base-operating period assumed to be the months of the following year. This is sometimes referred to as a year-around base pricing plan. Producers are paid on the basis of the base and excess prices as in Base-Surplus Plan I, but the base paying period involves all months of the year.

No actual prices have been generated by the Oklahoma Metropolitan Federal order for operation under Base-Surplus Plan II. In order to calculate base prices to be utilized in deriving the total revenue of

various producers under this plan, it was necessary to make several assumptions. The assumptions are first that the monthly market Class I utilization is 32,650,871 pounds of milk. This was arbitrarily selected as the 12-month moving average of utilization for September, 1959 through August, 1960 for the Oklahoma Metropolitan area. Second, given this assumed level of Class I utilization, it is assumed that approximately 78 per cent of total producer milk receipts would go into Class I utilization. Thus, approximately 41,860,000 pounds of milk per month on the average is assumed to be the level of total production in the Oklahoma Metropolitan milk market. Third, it is assumed that the seasonality of production and the seasonality of consumption in the market are the same under the Base-Surplus Plan II as under the Base-Surplus Plan I which existed from 1951 until 1960.

Given these three assumptions, total production and Class I utilization were calculated for each month in the production year. They were computed as the product of the index of seasonality and the assumed quantity for each variable.

Fourth, it is assumed that about 86 per cent of average monthly production is the average amount of base milk marketed per month. This is approximately the percentage that monthly average base milk was of the monthly average total quantity marketed under Base-Surplus Plan I. This estimate multiplied by the average daily total production for the market gives an estimate of average daily base milk marketed of approximately 1,200,000 pounds which, when multiplied times the number of days of each month, yields an estimate of the quantity of base milk marketed per month. Then, Class I and II utilization quantities of milk for each month were expressed as a per cent of the quantities of base milk

marketed during the respective months. The Class I and II utilization estimates were multiplied by the appropriate Class I and Class II milk prices reported in Chapter II to obtain the base "blend" prices applicable in each month. The final blend prices are included in Table XVIII.

Returns above feed costs for the various seasonal production patterns under Base-Surplus Plan II relative to a perfectly level producer are included in Table XXII. Producers with level seasonal patterns have the greatest returns. They are within three to four cents per hundredweight of the maximum potential returns as exhibited by a perfectly level pattern producer. There are incentives for all other patterns to adjust to a more nearly level pattern. These incentives range from 8 to 20 cents per hundredweight and tend to be highest for producers with either a winter-high or a spring high-fall low pattern. Under the "typical 30-cow herd" assumption, these incentives range from 216 to 540 dollars per year. There is a tendency for the incentive to be greatest for the small size producers in each market.

Adjustments in seasonality of production under Base-Surplus Plan II are non-selective with respect to the season of the year for the highs and lows. There is as much penalty for a given amount of production over base during the fall months as during the flush spring months. If one aim of the pricing mechanism is to stimulate production during the relatively short months, the year-around base plan would be ineffective. In fact, the effect of this plan might be contra-seasonal if producers with fall or winter highs adjusted their seasonal high patterns to either the spring or summer seasons. There is a small incentive ranging from two to five cents per cwt. for such an adjustment by the larger size producers.

TABLE XXII

BASE-SURPLUS PLAN II: RETURNS ABOVE FEED COSTS RELATIVE TO THE TWO STANDARDS OF COMPARISON FOR SELECTED MARKET, PRODUCER SIZE, AND SEASONAL PATTERN CLASSIFICATIONS

City	Pattern Classification	Size	Base-Surplus Plan II Difference From: Potential	Base-Surplus Plan II Difference From: Uniform	Modified Base-Surplus Plan II Difference From: Potential	Modified Base-Surplus Plan II Difference From: Uniform
			(Cents Per Cwt.)			
1 & 2	Spring High-Fall Low	A	-19.5	5.4	-19.5	3.8
1	Spring High-Fall Low	B & C	-15.4	9.4	-15.4	7.8
2	Spring High-Fall Low	B & C	-17.5	7.3	-17.5	5.8
1	Spring High-Nonfall Low	A	-12.9	11.9	-12.9	10.4
2	Spring High-Nonfall Low	A	-14.8	10.0	-14.8	8.5
1	Spring High-Nonfall Low	B & C	- 8.6	16.3	- 8.6	14.7
2	Spring High-Nonfall Low	B & C	-10.2	14.7	-10.2	13.1
1	Level (No High)	A	- 3.6	21.3	- 3.6	19.7
2	Level (No High)	A	- 3.1	21.8	- 3.1	20.2
1 & 2	Level (No High)	B & C	- 3.6	21.3	- 3.5	19.8
1	Winter High	A,B & C	-15.9	9.0	-15.5	7.8
2	Winter High	B & C	-15.6	9.3	-15.0	8.3
1	Summer High	A	-13.2	11.6	-12.9	10.4
2	Summer High	A	-16.2	8.7	-15.7	7.6
1 & 2	Summer High	B & C	-11.3	13.6	-11.0	12.3
1	Fall High	A	-14.3	10.0	-14.2	9.1
2	Fall High	A	-13.0	11.9	-12.4	10.9
1	Fall High	B & C	-13.7	11.2	-13.0	10.3
2	Fall High	B & C	-14.7	10.2	-14.2	9.1

APPENDIX

The incentives to change production patterns under modified Base-Surplus Plan II are about the same as under the original plan. However, lower prices during April, May, and June increase the relative disadvantage of producers with a spring-high seasonal production pattern.

Returns to producers with various seasonal production patterns operating under Base-Surplus Plan II compared with the returns of a perfectly level producer operating under a Uniform-Blend pricing system are also included in Table XXII. In all cases, the returns are greater under Base-Surplus Plan II. This situation resulted from the level of prices used in the study. Presumably, it could be assumed that the restrictions on production under Base-Excess Plan II would result in base prices higher than under the other plans. This might exist in the short run, but might be eliminated through increased production and lower blend prices in the longer run. Ignoring the absolute level of returns, producers would have an incentive to even out, or at least change, seasonal production patterns. The spring high-fall low pattern and the winter-high pattern would be least profitable. The greatest returns would accrue to producers maintaining a pattern with no seasonal high. The spring high-non fall low pattern for the larger producers would be quite profitable, compared with most other patterns.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The primary purpose of this study was to analyze seasonal variation in production in the Oklahoma Metropolitan milk marketing area and to evaluate relative effects of four alternative pricing plans on typical seasonal production patterns. The study is based on a sample of 188 producers located in the Oklahoma City and Tulsa milksheds. For each producer, monthly production was expressed as a per cent of his 12-month moving average of production for the period 1951 through 1959 to facilitate producer classification. Producers were then classified with respect to (1) size of production, (2) magnitude of variation in production, and (3) seasonal pattern of production.

Under existing pricing plans the level of production increased but the seasonal variation in production decreased in each market. Seasonal variation in production decreased much more in the Oklahoma City than in the Tulsa market which reflects, in part, the decrease in the number of small size producers in Oklahoma City. Producers in Oklahoma City of all sizes decreased seasonal variation, but the medium size producers in Tulsa increased seasonal variation of production.

Results from analyses of variance indicated that statistically significant differences existed between the two markets, between the different producer sizes, and between the various seasonal patterns of

production. The differences between years did not appear significant for some seasons. The within-market comparisons indicated that the differences between sizes and between patterns within sizes were significant. However, within a given pattern, size was not always statistically significant. Pattern type appeared to be most important single source of variations in percentage of average production during each month.

The analysis of adjustments by producers indicated an almost randomness of adjustment during the two periods of time. Very few producers in either market maintained the same pattern and magnitude of seasonal variation. Of those producers adjusting magnitude, the majority decreased it. More than one-half of the producers in each market adjusted the pattern of seasonal lows and highs in production. During one period, 1951-1954, the major adjustments were toward the spring and no-high patterns in the Tulsa market. During a second period, 1955-1959, producers in the Oklahoma City market appeared to move randomly to every seasonal high pattern, but in the Tulsa market there was some movement toward a no-high pattern of production.

Four alternative pricing plans and their modifications were selected for study. These are (1) a Uniform-Blend Plan with no restrictions on entry or penalties for production during any month, (2) Base-Surplus Plan I with a four-month base forming period and a six-month base operating period, (3) Louisville Type Plan with deductions for milk sold during surplus months and a bonus for milk sold during the traditional short months, and (4) Base-Surplus Plan II with a year-around base forming and base operating period. The objective under each plan was to determine the economic incentives for eliminating or

decreasing the undesirable seasonal production patterns so that the supply of milk during each season of a production and marketing year will be in line with the demand for milk during that season. The relative efficiency of the various plans was judged on the basis of the size of the incentives provided to change the pattern of seasonal variation in production.

Two standards of comparison were used to evaluate the relative effectiveness of the four alternative pricing plans in providing those incentives. These are (1) an ideal, perfectly level pattern producer's returns above feed costs under each of the four alternative pricing plans considered and (2) the ideal, perfectly level pattern producer's returns above feed costs under the Uniform-Blend Plan.

The primary standard of comparison is returns above feed costs for an "ideal" producer operating under each of the alternative pricing plans and is referred to as the "potential" under the respective plan. The use of this standard indicates the theoretical potential returns above feed costs of the various pattern producers if each would attempt to completely level out his seasonality of production under each of the four plans. With respect to this "potential", very little adjustment in seasonal production patterns would occur under the Uniform-Blend Plan. Base-Surplus Plan I provided the greatest incentive to move away from a spring-high and toward a fall-high pattern. Some incentive existed to move to a fall high-spring low pattern under the Louisville Type Plan but the incentives were not as great as under Base-Surplus Plan I. Base-Surplus Plan II, both original and modified, provided considerable incentive for producers to move toward the "ideal" pattern. However, the size of the incentives were only intermediate between those existing under Base-Surplus Plan I and under the Louisville type of seasonal pricing

plan. In addition, Base-Surplus Plan II was non-selective with respect to the season of the year in which monthly highs and lows occur. Almost as much penalty was incurred by producers in the study with the winter-high as with the spring high-fall low pattern. Therefore, it appears that Base-Surplus Plan II must be combined with the Louisville Type Plan, or some similar arrangement, if it is to provide the same economic incentives to producers to adopt a relatively level seasonal production pattern as would exist under Base-Surplus Plan I. If the aim is to force the seasonality of production to the same pattern as the seasonality of consumption, then some variation of Base-Surplus Plan I or a combination of Base-Surplus Plan II and the Louisville Type Plan appears to be necessary.

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APPENDIX

APPENDIX TABLE I

NUMBER OF PRODUCERS WITH HIGH PRODUCTION DURING SPECIFIED SEASONS, MAJOR SIZE GROUPS, OKLAHOMA CITY SAMPLE, 1951-1959

Major Size Group	Season	1951	1952	1953	1954	1955	1956	1957	1958	1959
A	Winter	10	8	7	8	9	3	5	2	2
	Spring	29	29	21	23	20	20	13	13	11
	Summer	16	15	15	7	9	9	5	7	10
	Fall	2	3	3	5	5	2	3	6	4
	No-High	11	7	9	12	6	5	6	2	3
	Total	68	60	55	55	49	39	32	30	30
B	Winter	7	3	5	5	5	5	11	5	1
	Spring	6	9	9	8	8	15	8	7	8
	Summer	5	6	9	5	1	4	5	7	9
	Fall	3	3	6	7	5	13	11	12	6
	No-High	7	13	5	10	18	8	11	11	11
	Total	28	34	34	35	37	45	46	42	35
C	Winter	1	5	2	2	5	1	7	4	2
	Spring	1	1	3	2	4	4	3	4	4
	Summer	1	0	1	0	1	1	1	4	7
	Fall	0	0	0	2	1	5	5	8	8
	No-High	1	0	5	4	3	5	6	8	14
	Total	4	6	11	10	14	16	22	28	35

APPENDIX TABLE II

NUMBER OF PRODUCERS WITH HIGH PRODUCTION DURING SPECIFIED SEASONS, MAJOR SIZE GROUPS, TULSA SAMPLE, 1951-1959

Major Size Group	Season	1951	1952	1953	1954	1955	1956	1957	1958	1959
A	Winter	0	1	0	2	2	1	4	2	1
	Spring	10	26	14	13	11	7	9	7	7
	Summer	18	6	5	0	3	3	6	6	8
	Fall	2	0	3	2	1	4	2	3	0
	No-High	2	2	2	5	7	2	1	0	4
	Total	32	35	24	22	24	17	22	18	20
B	Winter	3	2	4	7	6	2	5	4	4
	Spring	14	16	23	15	16	20	12	10	11
	Summer	13	8	6	4	3	2	6	8	6
	Fall	3	3	4	5	4	7	6	9	4
	No-High	7	8	6	13	10	12	8	8	6
	Total	40	37	43	44	39	43	37	39	31
C	Winter	1	0	4	2	3	9	7	0	5
	Spring	7	8	5	8	10	8	6	12	10
	Summer	5	2	0	1	2	1	4	3	5
	Fall	1	0	1	2	4	3	5	10	4
	No-High	2	6	11	9	6	7	7	6	13
	Total	16	16	21	22	25	28	29	31	37

APPENDIX TABLE III

NUMBER OF PRODUCERS WITH LOW PRODUCTION DURING SPECIFIED SEASONS, MAJOR SIZE GROUPS, OKLAHOMA CITY SAMPLE, 1951-1959

Major Size Group	Season	1951	1952	1953	1954	1955	1956	1957	1958	1959
A	Winter	6	15	12	10	10	9	4	9	6
	Spring	3	1	2	4	3	3	3	3	4
	Summer	13	16	15	16	13	9	7	4	8
	Fall	33	16	16	14	18	14	13	7	7
	No-Low	13	12	10	11	5	4	5	7	5
	Total	68	60	55	55	49	39	32	30	30
B	Winter	2	4	6	4	4	8	3	13	12
	Spring	2	1	5	3	3	4	5	4	2
	Summer	11	8	8	11	8	15	10	12	5
	Fall	5	10	8	8	8	6	8	4	4
	No-Low	8	11	7	9	14	12	20	9	12
	Total	28	34	34	35	37	45	46	42	35
C	Winter	0	0	0	0	2	0	2	4	6
	Spring	0	1	0	0	0	1	2	4	7
	Summer	2	1	2	7	5	7	8	6	7
	Fall	1	0	2	1	3	2	1	4	3
	No-Low	1	4	7	2	4	6	9	10	12
	Total	4	6	11	10	14	16	22	28	35

APPENDIX TABLE IV

NUMBER OF PRODUCERS WITH LOW PRODUCTION DURING SPECIFIED SEASONS, MAJOR SIZE GROUPS, TULSA SAMPLE, 1951-1959

Major Size Group	Season	1951	1952	1953	1954	1955	1956	1957	1958	1959
A	Winter	9	19	9	5	5	4	8	9	6
	Spring	4	0	1	0	1	1	2	0	1
	Summer	0	2	2	10	4	6	7	3	1
	Fall	13	10	11	4	9	3	3	4	8
	No-Low	6	4	1	3	5	3	2	2	4
	Total	32	35	24	22	24	17	22	18	20
B	Winter	11	11	14	4	4	6	1	9	7
	Spring	1	0	1	2	2	3	7	3	1
	Summer	5	7	9	18	14	16	14	13	10
	Fall	14	8	10	7	6	7	6	6	5
	No-Low	9	11	9	13	13	11	9	8	8
	Total	40	37	43	44	39	43	37	39	31
C	Winter	5	7	3	1	7	6	1	6	5
	Spring	0	0	1	0	0	0	2	1	2
	Summer	0	7	9	19	11	15	10	7	9
	Fall	2	0	0	4	3	1	4	3	5
	No-Low	9	2	8	8	4	6	12	14	16
	Total	16	16	21	22	25	28	29	31	37

APPENDIX TABLE V

NUMBER OF PRODUCERS IN THE SAMPLE FOR NINETEEN REPRESENTATIVE CLASSIFICATIONS, OKLAHOMA METROPOLITAN AREA, 1951-1959

Pattern	City	Size	1951	1952	1953	1954	1955	1956	1957	1958	1959
Spring High-Fall Low	1 & 2	A	26	23	18	17	20	14	11	11	8
	1	B & C	4	0	3	2	4	3	4	2	3
	2	B & C	11	8	9	6	6	4	4	5	7
Spring High-Nonfall Low	1	A	10	16	14	14	8	17	8	9	9
	2	A	3	16	10	11	3	9	5	3	2
	1	B & C	3	6	4	4	8	9	4	7	9
	2	B & C	10	20	17	15	20	18	15	16	13
Level (No High)	1	A	11	9	10	16	6	5	12	11	9
	2	A	2	3	4	8	7	4	3	1	5
	1 & 2	B & C	18	25	24	30	38	32	26	25	37
Winter High	1	A,B & C	17	15	14	14	18	7	21	9	5
	2	A	0	1	2	3	2	0	3	2	2
	2	B & C	4	2	6	8	9	12	13	4	8
Summer High	1	A	16	14	21	8	9	8	5	9	15
	2	A	18	6	6	1	3	3	8	9	8
	1 & 2	B & C	24	15	9	8	7	9	14	17	22
Fall High	1	A	2	3	4	8	5	4	6	11	10
	2	A	2	0	4	5	1	4	2	4	1
	1	B & C	3	3	5	6	6	16	13	15	8
	2	B & C	4	3	4	4	8	10	11	18	7

APPENDIX TABLE VI

TOTAL PRODUCER RECEIPTS: MONTHLY PERCENTAGES OF TREND FOR THE OKLAHOMA METROPOLITAN AREA, 1950-1960

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1950[a]											86.53	94.55
1951[a]	100.21	90.73	102.07	99.25	115.37	107.57	111.20	103.34	96.19	92.51	86.38	92.32
1952	94.52	92.75	101.45	106.49	118.75	106.87	102.61	96.77	93.19	91.09	90.29	95.77
1953	100.61	93.26	105.64	107.96	116.12	100.62	100.54	100.91	94.96	95.44	95.64	100.40
1954	101.21	95.87	108.24	110.67	113.21	100.97	90.67	88.47	90.47	97.58	97.85	102.37
1955	101.93	92.99	109.28	111.11	111.47	98.33	93.83	90.59	95.94	100.73	97.41	99.38
1956	99.52	92.58	105.21	108.29	110.52	99.62	95.17	91.27	94.89	102.78	98.83	102.75
1957	102.10	92.96	107.13	107.83	113.13	93.45	93.86	94.60	97.63	103.56	97.31	102.41
1958	99.31	88.11	98.65	107.04	112.14	94.35	96.63	96.02	96.68	103.90	104.14	106.04
1959	99.40	87.76	99.90	100.83	110.98	99.93	96.99	97.11	103.31	103.32	98.35	100.77
1960[b]	96.96	88.92	90.75	100.01	115.34	103.46	102.59	103.64	100.78	99.04		
Average (10 yr.)	99.58	91.59	102.83	105.95	113.70	100.52	98.41	96.27	96.40	99.00	95.27	99.68

Source: Computed from data in: U. S. Department of Agriculture, Agricultural Marketing Service, Compilation of Statistical Material for the Oklahoma Metropolitan Milk Marketing Area, January 1954 - March 1961 and other reports prepared by the Market Administrator, Federal order No. 6.

[a]Muskogee milkshed data were not available prior to July, 1951. The percentages for 1950 and 1951 reflect this omission.

[b]Effective May 1, 1960, Ponca City, Enid, and Vance Air Force Base were added to the Oklahoma Metropolitan Marketing Area.

APPENDIX TABLE VII

CLASS I UTILIZATION: MONTHLY PERCENTAGES OF TREND FOR THE OKLAHOMA METROPOLITAN AREA, 1950-1960

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1950[a]											102.53	102.56
1951[a]	106.28	92.73	103.02	95.12	96.87	91.88	91.59	97.55	100.87	108.02	103.57	102.34
1952	106.70	99.22	103.33	98.21	97.98	90.22	96.68	95.84	103.03	108.10	100.32	101.76
1953	107.33	95.82	103.90	100.54	98.33	94.15	96.37	94.13	101.74	108.79	98.95	103.21
1954	104.53	94.45	104.30	98.46	95.95	91.57	99.10	97.19	104.44	106.83	102.21	105.84
1955	104.90	95.03	104.42	97.89	93.23	88.03	91.24	98.89	104.77	106.74	104.63	105.65
1956	104.76	97.60	104.25	95.75	97.28	92.48	93.06	98.87	103.24	109.91	102.99	101.20
1957	106.33	92.79	101.29	96.46	100.21	90.00	95.90	98.92	101.21	107.67	104.88	102.17
1958	108.26	94.99	103.28	97.99	99.81	87.11	92.43	92.91	103.61	109.47	106.26	108.40
1959	108.83	93.84	100.19	100.76	96.41	89.49	92.49	94.33	103.46	109.32	100.02	102.62
1960[b]	105.55	99.13	103.46	97.84	98.46	92.71	93.43	96.88	104.90	106.03		
Average	106.35	95.56	103.14	97.90	97.45	90.76	94.23	96.55	103.13	108.09	102.64	103.58

Source: Computed from data in: U. S. Department of Agriculture, Agricultural Marketing Service, Compilation of Statistical Material for the Oklahoma Metropolitan Milk Marketing Area, January 1954 - March 1961 and other reports prepared by the Market Administrator, Federal order No. 6.

[a]Muskogee milkshed data were not available prior to July, 1951. The percentages for 1950 and 1951 reflect this omission.

[b]Effective May 1, 1960, Ponca City, Enid, and Vance Air Force Base were added to the Oklahoma Metropolitan Marketing Area.

APPENDIX TABLE VIII

DAILY AVERAGE PRODUCTION PER PRODUCER: MONTHLY PERCENTAGES OF TREND FOR THE OKLAHOMA METROPOLITAN AREA, 1954-1960

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1954							89.7	86.8	90.3	94.1	97.6	99.7
1955	99.7	101.6	107.9	114.2	110.6	101.5	92.3	88.6	96.3	96.6	97.3	97.3
1956	98.1	98.3	104.7	111.5	110.7	102.8	95.5	89.0	94.7	98.0	98.9	100.4
1957	100.7	102.2	107.2	112.0	108.7	93.7	92.6	92.4	99.1	99.8	97.4	99.8
1958	97.4	96.1	97.2	109.5	110.6	96.9	95.5	94.0	97.2	99.4	103.5	102.5
1959	97.5	95.7	98.3	103.1	109.5	102.2	95.7	94.8	104.1	100.7	100.5	100.2
1960[a]	97.4	95.8	92.5	106.0	109.6	101.8						
Average	98.5	98.3	101.3	109.4	110.0	99.8	93.6	90.9	97.0	98.1	99.2	100.0

Source: Computed from data in: U. S. Department of Agriculture, Agricultural Marketing Service, Compilation of Statistical Material for the Oklahoma Metropolitan Milk Marketing Area, January 1954 - March 1961 and other reports prepared by the Market Administrator, Federal order No. 6.

[a]Effective May 1, 1960, Ponca City, Enid, and Vance Air Force Base were added to the Oklahoma Metropolitan Marketing Area.

APPENDIX TABLE IX

DAILY AVERAGE PRODUCTION PER PRODUCER: MONTHLY PERCENTAGES OF TREND FOR THE TULSA-MUSKOGEE MILKSHED, 1950-1956

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1950[a]											86.7	88.9
1951[a]	93.4	95.3	94.8	99.2	118.0	114.8	110.4	106.0	103.3	94.8	83.3	86.6
1952	89.5	93.2	96.5	109.5	122.1	113.1	102.9	96.9	98.4	88.8	88.4	91.5
1953	94.8	97.8	102.5	112.5	120.7	108.2	99.5	97.4	93.6	91.2	94.3	94.7
1954	97.1	101.7	104.1	114.7	115.6	107.1	89.8	85.6	88.9	91.8	95.7	97.2
1955	97.6	100.2	109.7	118.1	114.3	102.7	91.7	87.9	95.3	96.7	97.1	95.1
1956	95.8	96.5	104.3	114.4	114.3	104.9	95.6	88.2	94.0	97.1		
Average	94.7	97.4	102.0	111.4	117.5	108.5	98.3	93.7	95.6	93.4	90.9	92.3

Source: Computed from data in: U. S. Department of Agriculture, Agricultural Marketing Service, Compilation of Statistical Material for the Oklahoma Metropolitan Milk Marketing Area, January 1954 - March 1961 and other reports prepared by the Market Administrator, Federal order No. 6.

[a]Muskogee milkshed data were not available prior to July, 1951. The percentages for 1950 and 1951 reflect this omission.

APPENDIX TABLE X

DAILY AVERAGE PRODUCTION PER PRODUCER: MONTHLY PERCENTAGES OF TREND FOR THE OKLAHOMA CITY MILKSHED, 1950-1956

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1950											88.2	95.3
1951	101.2	102.0	104.3	104.3	112.8	110.1	103.9	94.2	91.2	87.9	89.1	95.5
1952	97.4	102.9	104.0	109.7	115.4	108.5	100.0	93.4	90.7	88.4	92.6	96.6
1953	100.7	103.6	105.2	107.4	111.5	102.2	97.8	100.6	95.6	91.9	95.3	97.2
1954	97.8	105.3	107.5	110.0	106.8	99.7	89.4	88.5	92.5	97.0	99.7	102.6
1955	102.0	102.9	106.0	109.0	105.9	99.7	93.1	89.2	97.0	96.5	97.6	99.7
1956	100.5	100.0	104.9	108.4	106.8	101.2	95.6	89.5	95.2	98.8		
Average	99.9	102.8	105.3	108.1	109.9	103.6	96.6	92.6	93.7	93.4	93.7	97.8

Source: Computed from data in: U. S. Department of Agriculture, Agricultural Marketing Service, Compilation of Statistical Material for the Oklahoma Metropolitan Milk Marketing Area, January 1954 - March 1961 and other reports prepared by the Market Administrator, Federal order No. 6.

APPENDIX TABLE XI

CLASS I PRICE PLUS PREMIUM: MONTHLY PERCENTAGES OF TREND FOR THE OKLAHOMA CITY MILKSHED, 1951-1959

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1951	101.8	105.9	106.2	102.2	97.9	104.6	99.3	97.7	96.7	96.1	103.5	105.2
1952	107.2	108.2	103.7	98.7	93.3	92.1	95.4	98.0	105.9	108.7	109.4	107.5
1953	101.7	99.9	99.6	93.4	91.7	89.8	98.2	101.3	100.7	100.3	104.5	104.5
1954	100.8	100.6	103.3	95.2	88.8	87.4	96.4	102.3	107.4	100.4	102.1	104.8
1955	104.0	103.5	103.4	98.3	94.6	94.8	99.2	101.8	102.4	99.7	100.8	101.2
1956	100.8	100.3	99.7	94.1	101.0	102.5	102.6	95.0	100.3	102.2	101.0	100.6
1957	101.0	100.3	100.0	100.1	96.4	96.3	99.0	101.8	100.2	100.7	101.2	101.0
1958	98.9	100.1	100.4	100.5	100.6	100.7	100.8	100.9	99.2	99.3	99.5	99.6
1959	99.8	99.9	100.0	100.0	100.1	100.2	100.3	100.3	100.3	100.3	98.3	99.3
Average	101.8	102.1	101.8	98.1	96.0	96.5	99.0	99.9	101.5	100.9	102.3	102.6

Source: Computed from data in: U. S. Department of Agriculture, Agricultural Marketing Service, Compilation of Statistical Material for the Oklahoma Metropolitan Milk Marketing Area, January 1954 - March 1961 and other reports prepared by the Market Administrator, Federal order No. 6; and Premium Data obtained from Bud Bailey, Manager, Central Oklahoma Milk Producers Association.

APPENDIX TABLE XII

CONCENTRATE FEED COSTS: MONTHLY PERCENTAGES OF TREND FOR OKLAHOMA COST SERIES, 1950-1959

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1950	99.3	98.2	99.3	101.4	109.0	101.8	102.8	101.4	95.6	92.3	93.4	97.7
1951	102.3	103.2	103.8	104.7	105.9	99.7	97.6	94.7	93.0	95.1	101.4	106.0
1952	106.3	104.8	102.3	101.7	100.0	96.9	96.9	101.4	102.6	102.0	102.6	102.3
1953	102.1	99.4	102.2	101.9	102.6	98.0	96.7	94.6	94.9	93.5	95.2	98.3
1954	101.0	103.8	104.5	107.6	102.8	94.2	92.5	96.2	97.6	100.0	105.5	102.1
1955	103.1	103.4	102.1	103.1	103.5	100.4	99.3	96.7	96.6	95.8	95.1	97.3
1956	98.8	99.6	98.9	100.8	104.9	97.4	95.6	99.6	98.9	98.2	102.2	104.3
1957	105.4	105.1	104.4	104.0	101.9	95.8	97.7	98.8	98.0	96.4	97.2	97.1
1958	97.5	100.4	102.5	103.8	105.1	96.2	97.1	97.9	95.4	93.8	95.9	102.5
1959	105.8	104.5	103.3	104.9	103.3	96.7	97.5	98.8	94.7	96.7	98.8	99.6
Average	102.16	102.24	102.33	103.39	103.90	97.71	97.37	98.01	96.73	96.38	98.73	100.72

Source: Unpublished data maintained by the Department of Agricultural Economics, Oklahoma State University.

VITA

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