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SEASONAL PRICING PLANS FOR CLASS I MILK IN OKLAHOMA

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Contents

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Milk production in Oklahoma follows a definite seasonal pattern. Production is highest during the spring months and lowest during the fall and early winter months. This pattern would not lead to serious marketing problems if a similar pattern existed for milk consumption; however, consumption is relatively stable from month to month.

This bulletin reports results of a study to evaluate different pricing plans which might stabilize seasonal variation of milk production in the Oklahoma City and Tulsa milksheds. The specific objectives were to analyze adjustments in seasonal variation of production under existing programs and to determine the economic incentives for changing production patterns which would exist under different programs.

Procedures

This study is based on data from the Oklahoma Metropolitan Marketing Area. Records were studied from a sample of 100 producers in the Oklahoma City milkshed and 88 producers in the Tulsa milkshed. Each of these producers sold Grade A milk in at least 11 months of each year during the period May, 1950 through May, 1960.

The Market Administrator's records provided data on producer receipts, utilization, prices, and base deliveries for both the total market and for each of the producers in the sample. Sufficient details were obtained to determine sizes and patterns of seasonal variation for each producer included in the sample. Because of trends and other long-run changes, data on producer receipts (or sales) were converted from pounds to percentages of 12-month moving averages for analysis of seasonal patterns.

Daily average deliveries per producer were used as the basic data for the study of market-wide adjustments in seasonal variation. The

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procedure was simply to compare recent patterns with patterns in earlier time periods and to compare trends in the Oklahoma market with trends in other markets.

More data and more detailed study are involved in analyzing changes in seasonal variation made by producers included in the sample than for the total market. Generally, the procedure was to analyze changes in the relative importance of these groups, select typical patterns for the Oklahoma market, and analyze the economic incentives to change seasonal variation under alternative seasonal pricing plans.

Classification Procedure

The classification of producers into groups was complex since each Grade A milk producer had a unique seasonal production pattern each year. Four major criteria appeared to be important in classifying producers into approximately homogeneous groups. These were (1) location, (2) year, (3) size, and (4) pattern type.

Location was defined as Oklahoma City and Tulsa, coded as 1 and 2, respectively. Year was defined as the calendar year, January through December from 1951 through 1959. Size was defined as the average monthly deliveries of milk for the calendar year with both major and minor size groupings as shown in Table 1. Pattern type was defined with a set of code numbers indicating magnitude or the relative fluctuation of monthly production, the season of the year with highest average monthly production, and the season of the year with lowest average monthly production. Magnitudes were defined as stable (coded as 1) if monthly deliveries during the year fluctuated between

Table 1.—Producer Size Classifications

Size Codes		
Major	**Minor**	**Average Monthly Production**
		(*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

80.0 and 119.9 percent of the 12-month moving average of production; intermediate (coded as 2) if the monthly deliveries during the year reached as high as 120 to 140 percent of the moving average or as low as 60 to 80 percent of the moving average; and unstable (coded as 3) if the delivery in any month was as much as 40 percent above or below the 12-month moving average.

Seasons of the year were defined as follows: (1) Winter—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 were coded 1, 2, 3, and 4, respectively. To be classified as a pattern there must have been evidence of a regular pattern of variation, based on inspection of data for each producer during each year, with a tendency for production to be highest in one season or lowest in another season, or both. A code of 6 was used when no evidence of a regular low or high existed. Also definite patterns were classified only when the magnitude was 2 or 3. No pattern was recognized for magnitude 1 even though a definite pattern may have been followed within the arbitrary range of 20 percent above or below average.

Seasonal Pricing Plans

Plans in Effect

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. About one year later, a Federal order was also established in Muskogee.

Minimum price under Federal order was based on prices of milk in different manufacturing uses plus a differential for producing Grade A rather than Grade C milk. The minimum price was to be set at a level to 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 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 (originally April, May, and June) 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 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. 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

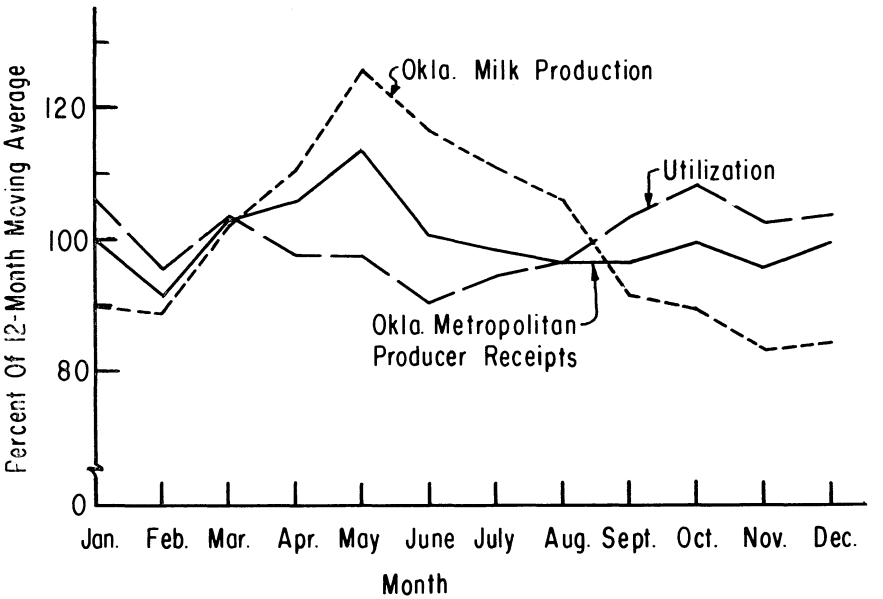

Figure 1. Average Seasonal Variation in Oklahoma Metropolitan Area Producer Receipts and Utilization and Oklahoma Milk Production, 1950-1959.

Source: Computed from data in (1) 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 (2) U. S. Department of Agriculture, Statistical Reporting Service, *Milk Production,* Da1-1 (February, 1962), Table 7.

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.

Market Adjustments

Average patterns of seasonal variation for Oklahoma during the 1950 decade are shown in Figure 1. Milk production was highest during the spring months and averaged 25 percent above average during May. It was lowest during the fall months, at about 16 percent below average in November and December. The pattern for milk consumption as reflected in utilization was the reverse of the pattern for production, but the fluctuations were considerably less. The variation was also less for producer receipts in the Oklahoma Metropolitan Area than for milk production in the State as a whole. It should be mentioned that

the fluctuations are slightly exaggerated since each month does not include the same number of days. February is the extreme case with a decline indicated for all series. Actually, all series increased on a daily basis from January through March.

The average pattern of seasonal variation in producer receipts conceals important changes which occurred in that pattern since 1950. The patterns for selected time periods are shown in Figure 2. In the early part of the period, 1951-52, producer receipts followed about the same pattern as total milk production for the State. Production increased to a peak in May then declined to a trough in the fall months of November and December. By the end of the decade, 1958-59, both the timing and the extent of variation had been changed. The peak was still in May, but production was only about 10 percent above average. The trough had moved up to August with production of only about 8 percent below average. Production was slightly above average

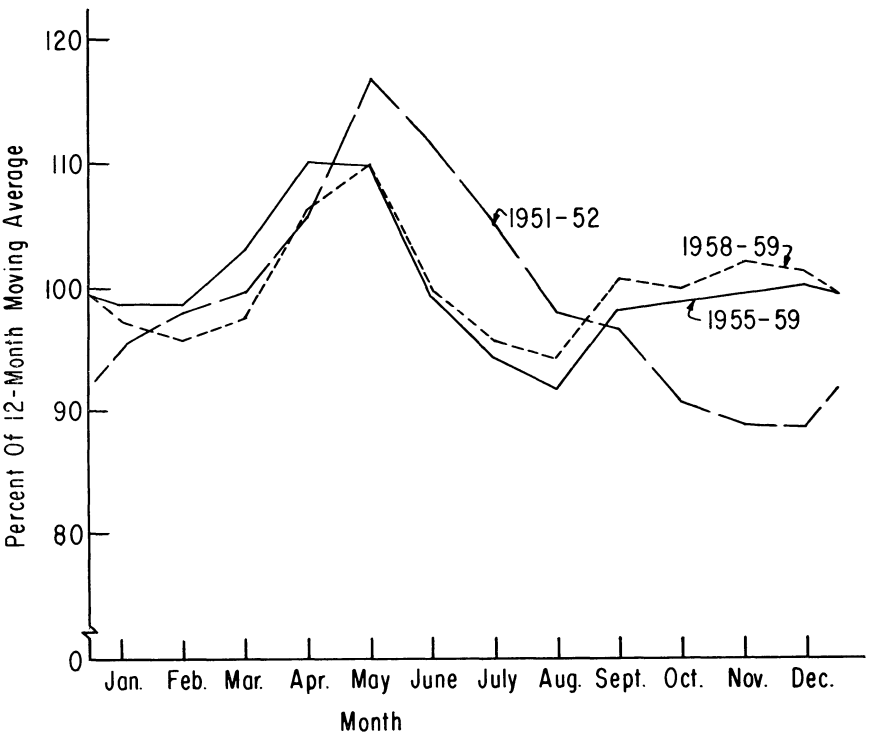

Figure 2. Average Seasonal Variation in Daily Average Delivery per Producer, Oklahoma Metropolitan Area, Select Time Periods.

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.

in the traditional short months of September through December. Most of this adjustment appeared to be a direct result of the base-surplus pricing plan which had been in effect during most of the decade.

Further evidence of this adjustment is provided in Figure 3 in which percentages of trend are shown for daily average production for Oklahoma City, Tulsa-Muskogee, and the combined markets. 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.

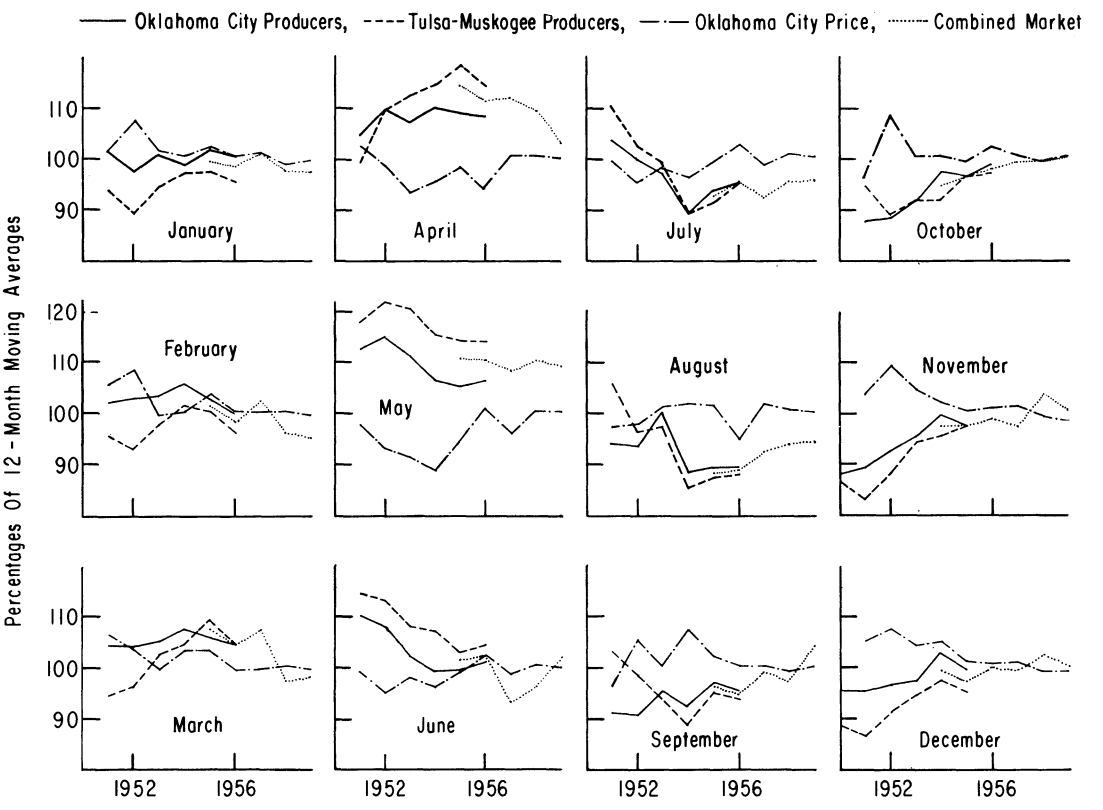

Figure 3. Relative Class I Price and Daily Average Delivery per Producer in Selected Oklahoma Markets for Each Month, 1951-1959.—The relative values are expressed as percentages of 12-month moving averages. When these values move toward 100 over time, this is evidence that seasonal variation has decreased. Seasonal variation has increased when they move away from 100.

Source: Computed from data in (1) 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 (2) records furnished by Bud Bailey, Manager of Central Oklahoma Milk Producers Association, Oklahoma City, Oklahoma.

One of the reasons given by the producers organization for the request that the base-surplus plan be eliminated from the Federal order was the contention that the base plan provided an incentive to expand production. Apparently, the personnel in the office of the Secretary of Agriculture agreed with this contention, based on the following statement: "The base plan has failed to level out production and may actually have stimulated production when it was not needed on the market."*

The information presented above appears to contradict the first part of this statement unless a perfect leveling is envisaged. However, the question of whether or not the base plan provided an incentive to expand production is not easily answered. Many forces have been operative in fluid milk markets to result in expansion of production. Among these are (1) the acceleration of the development and adoption of new technology in milk production, (2) a change in market structure to include greater security for an individual producer in terms of both price stability and the assurance that a physical market for the milk will exist, and (3) the rapid transition from the production of manufacturing milk or cream to the production of Grade A milk in response to economic and technical conditions.

The expansion of milk production in Federal order markets is reflected in both the increased number of producers and the increased size of deliveries. The latter, increasing daily average delivery per producer, was selected in this study to indicate general changes in production.

Daily average deliveries per producer have not been uniform among the Federal order markets, but have tended to increase during the 1950 decade in all markets. To reflect the relative changes, the average number of pounds delivered on each of 66 Federal order markets during 1956 was used as a base and average deliveries during the other years were expressed as percentages of the 1956 average deliveries. The averages of the percentages are shown in Figure 4. The increase in daily average delivery per producer was at the compound rate of about 7.9 percent per year for the complete 11-year period.** Also shown in Figure 4 is

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*Agricultural Marketing Service, U. S. Department of Agriculture, "Decision on Proposed Amendments to Tentative Marketing Agreement and to Order," 6CFR Part 906, Docket No. AO-211-A11, Milk in the Oklahoma Metropolitan Marketing Area, p. 5.

**$Y_1 = 59.31 \quad (1.07925)^{\times}$

where

Y_1 = index of daily average delivery per producer, average for 66 markets

$\times$ = year (1950 = 1)

The coefficients were fitted by the least-squares, single-equation technique with $R^2 = 0.98$, in logarithmic form

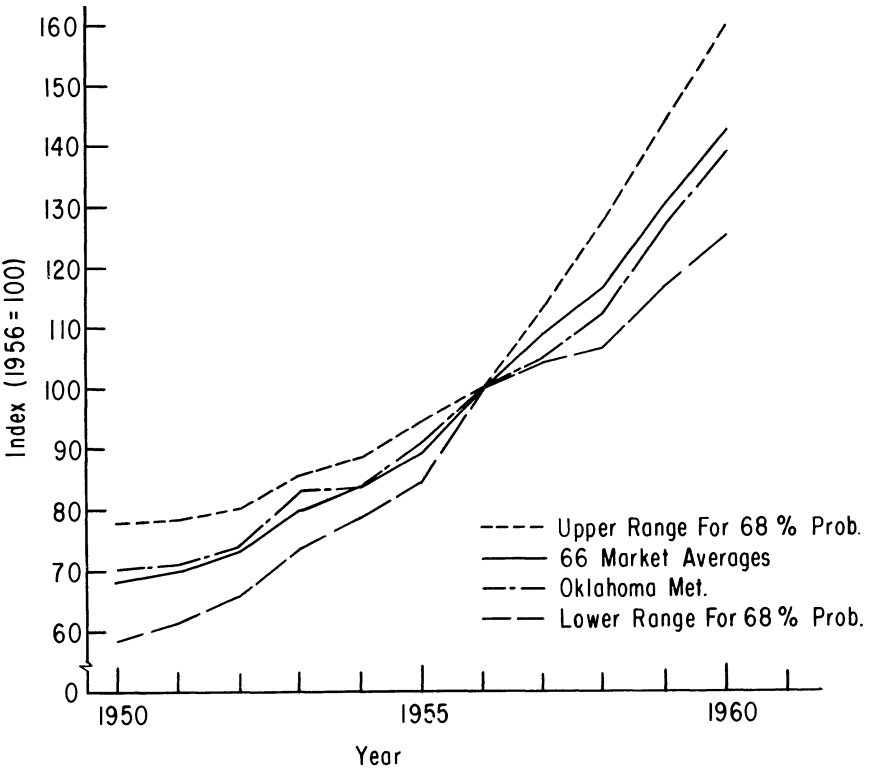

Figure 4. Index of Daily Average Delivery per Producer, Oklahoma Metropolitan Area and Average for 66 Federal Order Markets, 1950-1960.

Source: Computed from data in U. S. Department of Agriculture, Agricultural Marketing Service, *Federal Milk Order Market Statistics, 1947-56,* Statistical Bulletin No. 248, Table 14, and subsequent *Supplements.*

the range within which the percentages for about two-thirds of the markets would be expected to fall. This range is indicated by the dash lines on each side of the solid line representing the overall average.

Perhaps no market is closer to the average than the Oklahoma Metropolitan market. The Oklahoma series is represented by the dotted line in Figure 4. The rate of annual increase may be slightly less for Oklahoma than for all markets but the difference is slight. The compound rate of growth was 7.2 percent for the 1950-1960 period.*

*$Y_2 = 61.65\ (1.0720)^{\times}$

where

Y_2 = index of daily average delivery per producer, Oklahoma Metropolitan area

$\times$ = year (1950 = 1)

The coefficients were fitted by the least-squares, single-equation technique with $R^2 = 0.98$, in logarithmic form.

Within the Oklahoma market there were differences between the two major milksheds. Daily average delivery per producer, expressed as a percent of the 1956 average, was about the same during each year for the sample of long time producers in the Oklahoma City milkshed as for the whole market. However, the increase from 1950 to 1960 was much less in the Tulsa milkshed. This, in part, reflected differences in the average size of the producer. The daily average delivery of producers indicated in the Tulsa sample was 485 pounds in 1951, about 61 percent above the average for Oklahoma City. By 1959, the average had increased to 665 pounds but this was only 20 percent above the average for Oklahoma City. In other words, the greatest percentage gains were associated with Oklahoma City, but differences in the averages became smaller through the years.

On the basis of these comparisons there is little justification for concluding that the Oklahoma Metropolitan market has experienced increases in production which are different from those experienced in the other Federal order markets. Since all types of seasonal pricing plans are used in these various markets, it would appear that the particular seasonal pricing plan may not have been of major importance in determining the growth patterns. The conclusion is supported by comparing trends at least from 1953 through 1960 in three markets, each with a distinct type of plan (Figure 5). A fall base forming and spring base paying plan was used in Oklahoma City, a year-round base plan was used in Wichita, and a take-off and pay-back plan was used in the Louisville market.

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 all producers on the Oklahoma Metropolitan market (Figure 6). Differences which existed were slight. Moreover, the patterns were about the same for the Oklahoma City market as for the Tulsa market for the nine-year period.

Changes in Size

Seasonal variation in production probably is related to the size of dairy enterprise. It seems reasonable to expect more effort devoted to maximizing dollar returns from a major enterprise than from a minor enterprise. Therefore, changes in size alone may be responsible for change in seasonal patterns if some patterns yield significantly higher returns than others.

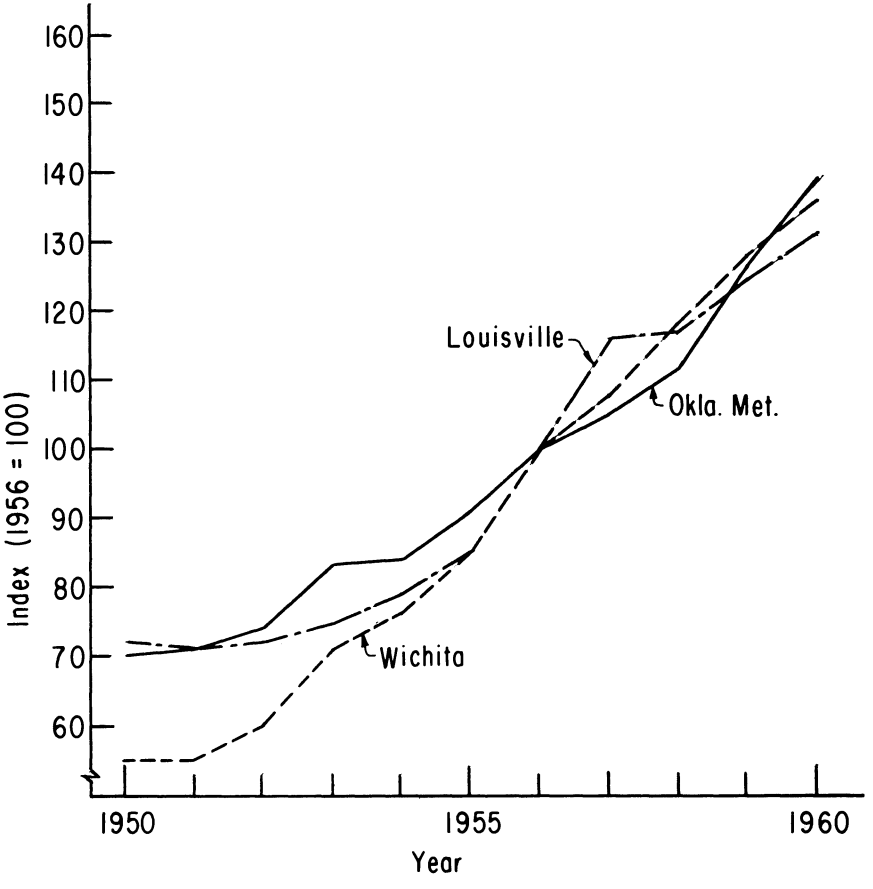

Figure 5. Index of Daily Average Delivery per Producer, Oklahoma Metropolitan, Wichita, and Louisville Markets, 1950-1960.

Source: Computed from data in U. S. Department of Agriculture, Agricultural Marketing Service, *Federal Milk Order Market Statistics, 1947-56,* Statistical Bulletin No. 248, Table 14, and subsequent *Supplements.*

The relative proportion of producers in each major size group in each market is included in Table 2. In the Oklahoma City market, there was a steady decline in the proportion of size A producers from 68 percent in 1951 to 30 percent in 1959. The proportion of size B and size C producers increased but the greatest increase occurred in the largest size group.

In the Tulsa market, sizes also increased. There was a somewhat erratic decline in the proportions of size A and size B producers and a consistent increase in the proportion of size C producers. Although the

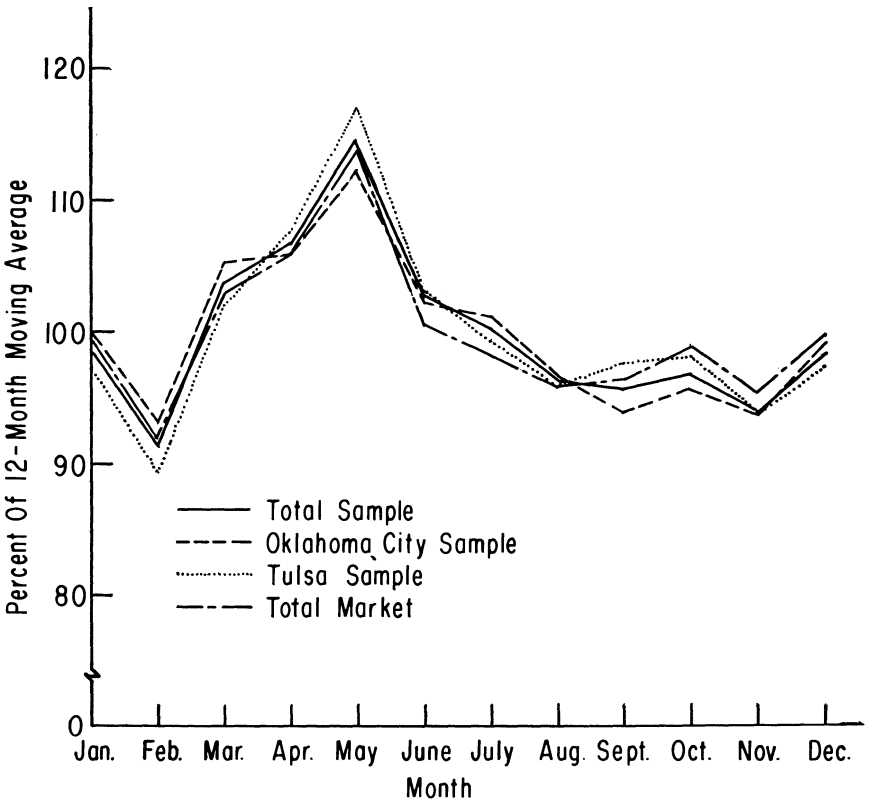

Figure 6. Average Seasonal Variation in Producer Receipts for the Oklahoma Metropolitan Area and for Oklahoma City, Tulsa, and All Producers Included in the Sample, 1951-1959.

proportion of size C producers was greater in the Tulsa than in the Oklahoma City market, the difference was smaller in 1959 than in 1951. These proportions reflect the higher daily average deliveries of long-time producers in the Tulsa milkshed.

Changes in Magnitude

Production tended to become more stable in the Oklahoma City milkshed from 1951 through 1959 in that the total number of magnitude 3 producers declined with no change in the number of magnitude 1 producers. In a similar comparison, relative stability was unchanged in Tulsa since the number of producers with the various magnitudes remained about the same.

In order to determine whether the decrease in magnitude occurred within each size group or whether it reflected individual producers

Table 2.—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*)[1]				
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

[1]Expressed as a percent of 100 in Oklahoma City and as a percent of 88 in Tulsa.

changing their production levels, a further classification was made. The number of producers classified as magnitude 1, 2, 3 was 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 3). 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. 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.

Table 3.—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 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 one major reason for the movement toward more stable seasonal production patterns.

Trends in Patterns

The percentage of producers of a given size in a given market in a given year with a high in production during each season was computed. A similar computation was made for the percentage with a low in production during each season. Trends were then calculated for changes in these percentages over the 1951-1959 time period. The estimated regression coefficients (b values) and the corresponding standard errors (s_b) are included in Table 4.

There was a consistent tendency among all sizes of producers in both markets for a decrease to occur in the percentage of producers with seasonal highs in production during the spring months. None of the coefficients, however, were statistically significant. In contrast, there was an increase in the percentage of producers with seasonal highs in the fall months. These trends were statistically significant except for the small size producers.

Trends were less uniform among the various classifications in the timing of seasonal lows than of seasonal highs. There was a decrease in the percentage of producers with seasonal lows in the fall which was statistically significant for the middle size group in each market. In Oklahoma City there were upward trends for the percentage of size A

Table 4.—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 percent probability level.
**Statistically significant at the 1 percent probability level.

producers with a low in the spring months and for the percentages of size B and size C producers with lows in the winter months. In Tulsa on the other hand, trends were downward for lows in the winter months, and there was an upward trend in the percentage of size B producers with lows in the summer months.

These trends indicate that producers were adjusting seasonal patterns toward highs in the fall. The shift was away from highs during the winter and spring months in Oklahoma City and from the spring and summer months in Tulsa. In the process of adjusting the timing of seasonal highs, seasonal lows were also changed. Relatively fewer producers had lows during the fall season. Seasonal lows shifted to the winter and spring months in Oklahoma City and to the spring and summer months in Tulsa.

Changes in Patterns During Select Time Periods

Additional evidence concerning the adjustments of seasonal patterns was obtained from comparisons of the number of producers in particular type classification at different time periods. Thirteen pattern classifications were selected for this phase of the analysis. Separate patterns were listed for (1) the level or no-high group, (2) the spring high-fall low group, (3) the spring high-nonfall low group, and (4) the groups with highs in each of the other seasons of the year. Generally, the groups were separated with respect to two different magnitudes of seasonal variation.

The first row under the Oklahoma City heading and the first row under the Tulsa heading in Table 5 lists the average number of producers (per 100 producers) within each classification in the 1951-52 period. The second row under each of the two headings lists the distribution in the 1958-59 period. In both markets there was a significant reduction in the number of producers with magnitude 3, spring-high and summer-high patterns of seasonal variation. Some of the reduction represented a net transfer within the magnitude 3 classification to a fall-high pattern.

Within the magnitude 2 classification, there was also a significant reduction in the number of producers with the spring high-fall low pattern and an increase in the number with a winter-high pattern for both markets. In addition, there was an increase for both markets in the number with the no-high pattern. For the remaining patterns, changes in the Oklahoma City market were almost opposite the changes in the Tulsa market. Some of this reflected the reduction in magnitude

Table 5.—Average and Equilibrium Percentage of Producers with Specified Pattern Classifications, Oklahoma Markets, Select Time Periods.

	166	26X[1]	21X	224	22X	23X	24X	36X	31X	324	32X	33X	34X
Oklahoma City													
Average													
1951-52	9.5	8.5	9.5	8.0	7.5	8.5	3.0	2.5	6.5	12.0	10.0	12.0	2.5
1958-59	10.5	14.5	3.5	4.5	12.5	13.5	11.0	0.5	3.5	2.0	4.5	8.5	11.0
Net Change	+1.0	+6.0	—6.0	—3.5	+5.0	+5.0	+8.0	—2.0	—3.0	—10.0	—5.5	—3.5	+8.5
Equilibrium													
A	10.6	12.8	6.2	5.6	11.5	10.4	8.6	1.3	5.8	6.1	6.4	7.1	7.6
B	10.4	13.2	4.3	4.7	11.8	11.4	11.6	--	4.9	3.9	6.4	8.1	9.3
Tulsa													
Average													
1951-52	9.1	5.7	3.4	10.2	15.3	15.9	4.0	0.6	0.6	8.0	12.5	13.6	1.1
1958-59	8.5	10.2	4.0	6.2	13.1	11.4	8.0	2.3	5.1	6.8	6.2	9.1	9.1
Net Change	—0.6	+4.5	+0.6	—4.0	—2.2	—4.5	+4.0	+1.7	+4.5	—1.2	—6.3	—4.5	+8.0
Equilibrium													
A	10.8	10.8	6.5	4.8	16.1	7.5	6.4	1.7	5.6	7.2	10.4	5.3	6.9
B	10.0	8.9	6.7	3.9	13.7	7.7	7.3	1.7	5.6	6.4	8.6	9.9	9.6

[1]X may represent a definite, but unspecified, seasonal low as well as no-low.

rather than the change in pattern for the Oklahoma City market. For example, there was a net reduction of only 0.5 producers in the total number of spring high-nonfall low patterns in Oklahoma City with a decrease in the number with magnitude 3 almost equal to the increase in the number with magnitude 2. In Tulsa, the net reduction was 8.5 producers for the same pattern type. There was more similarity between the two markets in the distribution of producer numbers in the various pattern types in the 1958-59 period than in the 1951-52 period. Since producer sizes were also more nearly comparable at the end of the period, this substantiates in part the tentative conclusion that some of the reduction in seasonal variation of production was associated with increasing size of producers.

The adjustments in seasonal patterns made by individual producers during two time periods were studied in detail. The time periods were 1951 to 1954 and 1955 to 1959. The results from that study indicated that some trends appeared to be evident but that many of the changes in patterns appeared to be random.* These findings suggested that a relatively new procedure, the Markov chain process, could be used to determine the equilibrium number of producers included in each pattern type after many years of adjustment.** This procedure involves the determination of the probable distribution of producers with various pattern types at a future time based on changes which have occurred during some past time period. Two time periods of past events were selected. The first was the nine-year period 1951-59; the second was the five-year period 1955-59. Equilibrium conditions based on these time periods are referred to in Table 5 as A and B, respectively. Since the Federal order program was new in the early years, primary emphasis will be on B, the equilibrium conditions using the 1955-59 data. These data should reflect the time paths under continuous operation of the base surplus plan without giving undue emphasis to early adjustments from no plan to the base surplus plan.

Only about 10 percent of the producers would have seasonal production patterns classified as stable in the Oklahoma City market under equilibrium conditions. However, an additional 13 percent, primarily those with a magnitude of 2, would have a pattern with no-high. In total this represents about one-fourth of the producers.

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*These results are reported in Elton O. Brooks, "An Economic Analysis of Seasonal Pricing Plans for Class I Milk in the Oklahoma Market" (Unpublished Master's Thesis, Oklahoma State University), Ch. III.

**For a discussion of this procedure and its application see G. G. Judge and E. R. Swanson, *Markov Chains: Basic Concepts and Suggested Uses in Agricultural Economics*, Illinois Agricultural Experiment Station Research Report AERR-49, December, 1961.

About 44 percent of the Oklahoma City producers would have a magnitude of 2 and a high during one of the seasons of the year. Proportionally more of these would have a high in the spring than in other seasons, but few would be classified as the spring high-fall low pattern. Almost 33 percent of the Oklahoma City producers would have a magnitude 3 seasonal variation in production. The indicated numbers are fairly evenly distributed among highs during the spring, summer, and fall.

The same percentage of the producers would have stable seasonal production patterns under equilibrium conditions in Tulsa as in Oklahoma City. However, slightly fewer producers would have the no-high pattern (26X and 36X).

About 39 percent of the Tulsa producers would have a magnitude of 2 and a high during one of the seasons of the year. More would have a high in the spring than in other seasons, and most of them would have the spring high-nonfall low pattern. About 40 percent of the Tulsa producers would have a magnitude of 3 and a definite pattern. This percentage is somewhat greater than for Oklahoma City and includes relatively more spring-high pattern producers.

Variability in Seasonal Production Patterns

Analysis of variance techniques were used to evaluate the variability in seasonal production patterns for the producers included in the sample. The analysis applied to variation in the percentages of the 12-month moving averages of deliveries for each month. Differences in the percentages for a given month were postulated to results from differences in (1) the location of the producer (either the Oklahoma City or Tulsa milkshed), (2) the size of the dairy enterprise as reflected in average monthly deliveries, (3) the pattern classification, and (4) the year. A hierarchical analysis of variance technique was used.*

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*The model was

$$Y_{ijklm} = \mu + A_i + B_{ij} + C_{ijk} + D_{ijkl} + E_{ijklm}$$

where

Y = observed monthly production as a percent of the 12-month moving average of production

μ = mean

A = city

B = size

C = pattern

D = year

E = error

and i = 1, 2; j = 1, 2,...9; k = 1, 2,...21; l = 1, 2,...21; m = 1, 2,...n; and n = 1, 2,...1692.

The results from the analysis of variance tests are included in Table 6. A summary of the tests is as follows: (1) city differences were important in 10 months of the year, (2) producer size differences were important in all months, (3) pattern differences were important in all months, and (4) year differences were important only during six months of the year. Based on these results, all factors tested must be considered separately except possibly the year. The possibility exists for combining data for the nine individual years.

A modification of the model was made to test for differences attributable to each of the factors within a given market. These results are included in Table 7. As for the original model, significant differences were obtained for pattern type and producer size but differences between years were questionable. Differences between years were indicated only for six months in Oklahoma City and four months in Tulsa, and none of these was significant at the 99 percent confidence level.

It appeared that the variability in the percentages would be less for any given pattern than for all patterns combined. However, not all patterns had equal representation in terms of numbers of producers. Some patterns appeared more important than others. For this reason, certain basic pattern types were selected from the original 21 possible patterns for further analysis. These were as follows: (1) spring high-fall low, (2) spring high-nonfall low, (3) winter high, (4) summer-high, (5) fall-high, and (6) level or no-high.

Analyses of variance computations were made for these six basic pattern types for each market to test for the effect of producer size. The results are included in Table 8. For the spring high-fall low pattern, size was important only for the months of May and November for Oklahoma City and for the month of September for Tulsa. A similar situation existed for the winter-high pattern; size was important in only one month. The same conclusions did not appear warranted for the spring high-nonfall low pattern. For this pattern, size was important for three months in Oklahoma City and for eight months in Tulsa.

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.

Table 6.—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**	2.03*	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 percent level.
**Empirical "F value" significant at the 1 percent level.

Table 7.—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 percent level.
**Empirical F significant at the 1 percent level.

Table 8.—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 percent level.
**Empirical F significant at the 1 percent level.

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

These results, plus the information gained from the previous analyses indicate that pattern is the most impotrant 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, the results from the other analyses, and 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 9. 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 when differences existed between the two milksheds.

Analysis of Incentives to Change Patterns Under Alternative Pricing Plans

Four alternative plans were considered in the analysis of incentives to change patterns or adopt a more even production pattern. The plans were as follows: (1) Uniform-Blend Plan; (2) Louisville Plan, a take-off and pay-back type of plan; (3) Base-Surplus Plan I, a plan almost identical to the plan existing from 1951 through 1959; and (4) Base-Surplus Plan II, a plan involving a year-around base operating period.

Table 9.—Selected Statistics on Average Seasonal Variation of Production in the Oklahoma Metropolitan Milk Marketing Area, Ninteen Representative Classifications[1], 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
		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
		s^2	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 continued next page

Table 9.—(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	93.86	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	14.05	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	93.95	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

[1]The number of producers in each classification each year is included in Appendix Table 3.

Incentives under each plan to change seasonal production patterns were defined in relative terms. That is, the incentives were expressed as extra returns (either positive or negative) relative to a standard. The basis for standard was a producer with marketings equal to 100 percent of the 12-month moving average production during each month of the year. Such a producer actually would have no seasonal variation, but in subsequent references either "even" pattern or stable producer may be used to refer to this standard. If the objective of each pricing plan is to reduce the seasonal variation of production, returns should be greatest for the stable producer. Therefore, returns to this producer will be referred to as potential returns, with returns defined as returns over feed costs. Returns to producers with other seasonal production patterns will be expressed as differences from the potential. The fact that relative returns to producers with some patterns can be positive under one or more plans is indicative that that plan does not actually give the greatest incentive to adopt the "even" pattern.

Returns above the feed cost computations required both a series of milk prices and a series of feed costs for each seasonal pricing plan. Neither series was available for the various pattern types under actual market conditions. Therefore, both series were estimated.

Basic Data and Assumptions

Prices

The estimated Class I prices were basic formula prices plus a Class I price differential. The basic formula price for a given month was the average of actual basic formula prices for the Oklahoma Metropolitan Area for that same month during the six-year period October, 1955 through September, 1960. The Class I price differential used was $1.95 per cwt. The estimated Class I prices were higher than the order prices but averaged about the same as the negotiated prices applicable in the Oklahoma City milkshed. Generally the Class I price was assumed to be consistent with about 78 percent utilization of milk as Class I on the total market. This percentage was the highest average annual utilization percentage which would permit 85 percent utilization during the month in which production was "shortest" relative to consumption, based on average seasonal variation patterns established for these two variables.

The Class II prices used in this study were the actual Class II prices for the Oklahoma Metropolitan Area. They are averages of the reported prices paid by plants in the Oklahoma area for manufacturing milk during the same six-year period as used for Class I milk, October, 1955 through September, 1960.

Under the Uniform-Blend Plan, each producer may deliver any amount of milk and receive a market blend or uniform price. This price is a weighted average price based on the proportions of Class I and Class II utilization of producer milk for the market and the respective prices. To obtain the blend price for this plan, a 10-year average of the percentages of trend (percent of 12-month moving average) for Class I utilization was determined. This pattern of average seasonal variation was applied to the 78 percent utilization to obtain the estimated Class I utilization percentage for each month. The Class II utilization was 100 percent minus the Class I utilization percentage. These percentages were used with the assumed Class I and Class II prices to obtain a uniform or weighted average price for each month (Table 10). This price series was used for both the Uniform-Blend Plan and the Louisville-Type Plan.

Under Base-Surplus Plan I, the uniform prices were used for the base forming months of September through December and the open months of January and August, but a new series was constructed for the base operating or base paying months of February through July.

Table 10.—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**

This series was the price to be used for the base milk. Since a type of base plan similar to Base-Surplus Plan I had been in effect in the Oklahoma market, some data were available. Estimates of the Class I utilization of base milk, expressed as percentages of the total quantity of base milk marketed, were derived for each base operating month of the period 1951 through 1960. Averages of the percentages were computed for each month. These averages were used with the estimated Class I and Class II prices in Table 10 to obtain a weighted average price designated as the base price. The excess price used was identical with the Class II price.

Under Base-Surplus Plan II there was a problem of price estimation. No actual prices had been generated by Oklahoma markets operating under this type of plan. Therefore, it was necessary to make several assumptions. These were as follows:

(1) The monthly average Class I utilization equaled 32,650,871 pounds. This was the monthly average utilization for September, 1959 through August, 1960.

(2) The monthly average producer receipts equaled 41,860,000 pounds. This was derived from assumption Number 1 and the assumption of 78 percent Class I utilization.

(3) The seasonality of production and consumption would be the same under Base-Surplus Plan II as existed under the base plans in effect during the 1950 decade.

(4) The daily average delivery of base milk was 86 percent of the daily average delivery of all milk for the year.

From the first three assumptions, production and Class I utilization were computed for each month. With the fourth assumption, monthly average delivery of base milk could be estimated for the number of days included in the month, and the percentages for Class I utilization of base milk could be determined. These percentages were used with the basic Class I and Class II prices to determine estimated monthly base prices. As in the other base plan, the Class II prices were used for the excess milk.

Costs

Only feed costs are considered in the study of incentives to change seasonal production patterns. Feed costs usually constitute about half of total costs and a large proportion of the variable costs (excluding family labor). This approach ignores the seasonality of costs of other

inputs, particularly labor. Feeds considered include concentrates, roughage supplied by pasture, and other roughage.

Each individual dairy farm will have a unique structure of costs and returns. It will differ from other farms in the quality of the herd, efficiency in the use of resources, and level of management. To standardize for these and other variables, assumptions were made for a "typical" dairy farm operating in the Oklahoma Metropolitan Area.* These were as follows:

(1) The typical cow in the herd produces 9,000 pounds of four percent butterfat content milk in 10 months, an average for the herd of 900 pounds per cow per month.

(2) The typical cow is fed 2,700 pounds of concentrates and 9,492 pounds of roughage during the 300-day production period.

(3) The typical cow receives one-half the ration in (2) above for the 60-day dry period.

(4) The herd replacement rate is one-fourth and the feed costs for the replacement animal are one-half the annual costs for a production animal.

(5) Pasture supplies 50 percent of the roughage requirement during the peak pasture season and a share of the roughage in the other months of the year.

(6) The annual prices of the basic feed inputs are:
   (a) concentrates—$2.84 per 100 pounds.
   (b) pasture—50 percent of other roughage cost per pound.
   (c) other roughage (alfalfa hay)—$25.00 per ton.

(7) The feed costs per 100 pounds of milk for any month are independent of the size of the dairy enterprise, the seasonal pattern of production, or the seasonal pricing plan in operation.

Roughage supplied by pasture for each month was estimated from Underwood's data on the animal unit days of full forage per acre provided by wheat, oats, sudan grass, and native pasture.** According to these data, the peak pasture season occurred in June with 17.42 percent of annual pasture supplied during this month (Appendix Table 1).

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*The assumptions were made in consultation with L. J. Bush, Department of Dairying and Clark Edwards, Department of Agricultural Economics, Oklahoma State University.

**F. L. Underwood, *Economic Survey of Resources Used by Dairy Farmers in Oklahoma*, Oklahoma Agricultural Experiment Station Bulletin No. B-482, Table 13.

Each of the other months was expressed as a percent of June and converted to pounds based on Assumption 5.

Although the total quantities of concentrates and roughages per 100 pounds of milk were not varied on a seasonal basis, the proportions of roughage supplied by pasture would introduce seasonal variation into the feed cost data. In addition, seasonal variation in the prices of the feed components was used. Seasonality in roughage prices were assumed to be the same as for alfalfa hay (Appendix Table 2). Seasonality in concentrate prices were assumed to be the same as the nine-year average seasonal variation in the unpublished prices of the mixed dairy feeds which are used in computing Oklahoma milk-feed price ratios.

Feed costs per 100 pounds of milk, based on the previous assumptions and calculations ranged from a low of $1.70 in June to a high of $2.36 in January and February. These estimates probably understate the seasonal variation of feed costs for some producers, particularly those who make a net substitution of roughage for concentrates and use pasture as the primary source of this roughage.

Alternative Pricing Plans

Uniform-Blend Plan

Producers may market any amount of milk in any month under the Uniform-Blend Plan. The only difference in gross incomes of producers with various seasonal production patterns is that which reflects the lower prices commensurate with the higher percentage of Class II milk in the spring and summer seasons. To a large extent the lower prices will be offset by lower feed costs.

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 to 2.0 cents per cwt. 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 cwt. of milk marketed by winter-high producers for not adjusting toward a more level production pattern (Table 11). Producers with a summer-high pattern of production all have larger returns above feed costs than the stable 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. For a 40-cow herd, a difference of 1.0 cent per cwt. is

Table 11.—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

equivalent to $3.00 per month or $36.00 per year. Therefore, the incentive for a producer with summer-high pattern to maintain this pattern rather than adopt a stable pattern is less than $75.00 per year. The maximum gain from changing patterns would accrue to producers with the winter-high pattern. These producers could receive increased returns over feed cost up to $72.00 per year by adopting a stable pattern and up to $147.00 per year by shifting to a summer-high pattern.

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.

The modified Uniform-Blend Plan as used in this study is the original Uniform-Blend Plan combined with a 40 cent per cwt. 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 provide about the same incentives to producers 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.

Louisville-Type Plan

Under the Louisville-Type Plan, producers are paid on the basis of the blend price. However, a deduction is made from this price during the "flush" production months. The money is placed in a pool, then is paid back during the "short" production months as an addition to or a premium over the blend price. Usually the deduction is less than the payback when both are expressed as cents per 100 pounds since more milk is marketed during the flush season.

Three combinations of months and money values were used. The first involved a deduction of 40 cents per cwt. during the four months of April, May, June, and July and a premium of 45 cents per cwt. during the four months period of September through December. The second combination involved the same months as the first but the deductions and premiums were twice as large (80 cents and 90 cents per cwt., respectively). The third combination involved the same per cwt. deductions and premiums as the first combination, but the deduction applied only to April, May and June and the premium only to October, November and December. Primary emphasis will be given to the first combination.

Incentives exist under the Louisville Type Plan for some producers to change the pattern of seasonal variation in production (Table 12). 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. Producers with winter-, summer-, and no-high patterns would incur

Table 12.—LOUISVILLE PLAN: Returns Above Feed Costs Relative to Standards of Comparison for Selected Market, Producer Size, and Seasonal Pattern Classification.

City	Pattern Classification	Size	Difference from Potential under Combination I —40¢ (AMJJ) +45¢ (SOND)	II —80¢ (AMJJ) +90¢ (SOND)	III —40¢ (AMJ) +45¢ (OND)
			(cents per cwt.)		
1 & 2	S H - F L	A	—8.6	—14.2	—7.4
1	S H - F L	B&C	—6.8	—10.8	—5.7
2	S H - F L	B&C	—7.4	—12.1	—6.4
1	S H other Low	A	—5.2	—7.6	—4.4
2	S H other Low	A	—5.3	—8.3	—4.5
1	S H other Low	B&C	—3.3	—4.1	—2.9
2	S H other Low	B&C	—3.5	—4.3	—3.3
1	Level	A	—1.1	—0.2	—1.0
2	Level	A	—0.5	0.8	—0.6
1 & 2	Level	B&C	—0.5	1.0	—0.5
1	Winter H	A,B,C,	—1.9	—0.3	—1.7
2	Winter H	B,C,	—0.5	2.4	—1.1
1	Summer H	A	—0.8	—1.1	—0.4
2	Summer H	A	0.9	1.5	1.0
1 & 2	Summer H	B&C	0.3	1.0	0.5
1	Fall H	A	3.6	9.4	3.0
2	Fall H	A	4.1	9.8	3.3
1	Fall H	B&C	3.4	8.9	2.7
2	Fall H	B&C	2.4	7.2	1.6

small losses under the Louisville Type Plan if they did not adjust toward the stable pattern.

The fall-high pattern producers have greater returns above feed costs than the stable pattern producer under the Louisville Type Plan. 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 cwt. to move toward a fall-high pattern. The incentive is largest for the small size producers with this pattern.

Doubling the deductions and premiums did not result in a doubling of the incentives to move to a stable pattern but it did approximately double the incentive to move from a spring-high fall-low pattern to a fall-high pattern. The incentive for the latter change was about 24 cents

per cwt. for the small producers and almost 20 cents per cwt. for the large producers. Except for the spring-high and fall-high patterns, doubling the rate did not appreciably affect the relative incentives.

The elimination of July and September from the periods involved in the computations did not change the incentives by much more than a cent per cwt. Both the incentive to move toward a fall-high and the penalty for maintaining a spring high-fall low pattern were reduced slightly.

Base-Surplus Plan I

Base-Surplus Plan I as used in this study has a base-setting period of September through December and a base-paying period of February through July. This is the same as the plan in operation during the last few years of the 1950 decade but includes more months than the plan originally instituted. Under this plan, a producer may participate in Class I sales during the base-paying period only through the base set in the previous fall period.

Returns above feed costs for producers with various seasonal production patterns operating under Base-Surplus Plan I are included in Table 13. Relative to the stable producer, 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. This would represent more than $1,000 as added annual returns above feed costs for the medium to large size dairy enterprise.

Small size producers with a spring high-nonfall 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-nonfall low pattern of production in either market to adjust seasonality of production toward stable patterns. 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 cwt. of milk

Table 13.—BASE-SURPLUS PLAN I. Returns Above Feed Costs Relative to the Standards of Comparison for Selected Market, Producer Size, and Seasonal Pattern Classifications.

City	Pattern Classification	Size	Base-Surplus Plan I Difference From Potential	Modified Base-Surplus Plan I Difference From Potential
			(cents per cwt.)	
1 & 2	Spring High-Fall Low	A	—39.2	—37.2
1	Spring High-Fall Low	B&C	—30.8	—29.2
2	Spring High-Fall Low	B&C	—32.8	—31.1
1	Spring High-Nonfall Low	A	—20.4	—19.5
2	Spring High-Nonfall Low	A	—20.9	—20.0
1	Spring High-Nonfall Low	B&C	—12.7	—12.2
2	Spring High-Nonfall Low	B&C	—12.9	—12.4
1	Level (No High)	A	— 4.7	— 4.4
2	Level (No High)	A	— 2.0	— 1.9
1 & 2	Level (No High)	B&C	— 2.5	— 2.4
1	Winter High	A,B&C	—13.1	—12.4
2	Winter High	B&C	— 8.8	— 8.3
1	Summer High	A	— 8.3	— 7.6
2	Summer High	A	— 5.6	— 5.0
1 & 2	Summer High	B&C	— 4.3	— 4.0
1 F	Fall High	A	— 1.6	— 0.9
2	Fall High	A	— 0.9	— 0.3
1	Fall High	B&C	— 1.4	— 0.7
2	Fall High	B&C	— 1.5	— 1.2

marketed for not adjusting their seasonal pattern toward the stable pattern.

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 incentives under this plan to switch from the spring high-fall low pattern to another pattern are significantly larger than under the Louisville-Type Plan. The incentives to change from the spring-high to the fall-high pattern are triple those with the 40 cent deduction under Combination I and 50 percent more than those with the 80 cent deduction of Combination II.

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.

Returns above feed costs for the various seasonal production patterns under Base-Surplus Plan II relative to a stable pattern are included in Table 14. Producers with level seasonal patterns had the greatest returns. They were within three to four cents per cwt. of the maximum potential returns. There were incentives for all other patterns to adjust to a more nearly level pattern. These incentives ranged from 8 to 20 cents per cwt. and tended to be highest for producers with

Table 14.—BASE SURPLUS PLAN II: Returns Above Feed Costs Relative to the Standards of Comparison for Selected Market, Producer Size, and Seasonal Pattern Classifications.

City	Pattern Classification	Size	Base-Surplus Plan I Difference From Potential	Modified Base-Surplus Plan I Difference From Potential
			(*cents per cwt.*)	
1 & 2	Spring High-Fall Low	A	—19.5	—19.5
1	Spring High-Fall Low	B&C	—15.4	—15.4
2	Spring High-Fall Low	B&C	—17.5	—17.5
1	Spring High-Nonfall Low	A	—12.9	—12.9
2	Spring High-Nonfall Low	A	—14.8	—14.8
1	Spring High-Nonfall Low	B&C	— 8.6	— 8.6
2	Spring High-Nonfall Low	B&C	—10.2	—10.2
1	Level (No High)	A	— 3.6	— 3.6
2	Level (No High)	A	— 3.1	— 3.1
1 & 2	Level (No High)	B&C	— 3.6	— 3.5
1	Winter High	A,B&C	—15.9	—15.5
2	Winter High	B&C	—15.6	—15.0
1	Summer High	A	—13.2	—12.9
2	Summer High	A	—16.2	—15.7
1 & 2	Summer High	B&C	—11.3	—11.0
1	Fall High	A	—14.8	—14.2
2	Fall High	A	—13.0	—12.4
1	Fall High	B&C	—13.7	—13.0
2	Fall High	B&C	—14.7	—14.2

either a winter-high or a spring high-fall low pattern. Under the assumption of a 40-cow herd, these incentives ranged up to 600 dollars per year. There is a tendency for the incentive to be greatest in terms of cents per cwt. 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 months. There is a small incentive ranging from two to five cents per cwt. for such an adjustment by the larger size producers.

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.

Summary and Conclusions

The purposes of this study were to analyze seasonal variations in milk production in the Oklahoma Metropolitan Marketing Area and to evaluate the probable effectiveness of four alternative seasonal pricing plans in changing seasonal production patterns. The study is based on data from the complete market and on data from a sample of 188 producers, 100 in the Oklahoma City milkshed and 88 in the Tulsa milkshed. To isolate seasonal variation patterns, data were expressed as percentages of 12-month moving averages and covered the period May, 1950, through May, 1960. Producers were classified by (1) size of production, (2) magnitude of seasonal variation in production, and (3) seasonal pattern of production in order to obtain fairly homogeneous groups for the analysis.

The plans used under the Oklahoma Metropolitan Federal Order were described. Under these plans the level of production increased at the compound rate of 7.2 percent per year, but this increase was not different from most Federal Orders Markets. The seasonal variation in production decreased in both major Oklahoma milksheds but decreased much more in the Oklahoma City milkshed than in the Tulsa

milkshed. This reflects, in part, the absolute and relative decline in the number of small size producers in the Oklahoma City area. Producers of all sizes in the Oklahoma City area decreased seasonal variation in contrast to the decrease by only the small and large producers in the Tulsa area.

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 the most important single source of variations in percentage of average production during each month.

The analysis of adjustments in seasonal patterns indicated an almost random change. Very few producers in either milkshed maintained the same magnitude and pattern of seasonal variation from year to year. Equilibrium conditions achieved after many years of adjustment to conditions existing during the 1950 decade were estimated. In the Oklahoma City milkshed only 10 percent of the producers would be classified as stable. About 44 percent would have a magnitude of 2, but few would be classified as spring high-fall low even though the largest percentage would still have a spring-high. Almost one-third would have a magnitude 3 classification with highs evenly distributed among the various seasons. In the Tulsa milkshed, estimated equilibrium conditions were similar except that more producers would have a spring-high pattern and more would have a magnitude 3 classification.

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) Louisville-Type Plan with deductions for milk sold during surplus months and a bonus for milk sold during the traditional short months, (3) Base-Surplus Plan I with a four-month base forming period and a six-month base operating period, 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.

The standard of comparison is returns above feed costs for a producer with a perfectly level pattern 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 potential returns above feed costs of producers with the other patterns if they attempted to completely level out the seasonality of production under each of the four plans. With respect to this standard, 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 Combination I of the Louisville Type Plan but the incentives were not as great as under Base-Surplus Plan I. The incentives would be greater under Combination II. Base-Surplus Plan II, both original and modified, provided considerable incentive for producers to move toward the stable 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.

Appendix Table 1.—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[1]	68.80	66.30	83.80	167.50	403.80	489.50	440.10	342.60	240.00	150.90	170.80	185.50

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

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

Appendix Table 2.—Selected Statistics on Feed Prices and Assumed Feed Costs Per Month and Per Hundredweight, 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[1]												
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
Concentrates	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

[1]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.

Appendix Table 3.—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-	1 & 2	A	26	23	18	17	20	14	11	11	8
Fall Low	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-	1	A	10	16	14	14	8	17	8	9	9
Nonfall Low	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

OKLAHOMA'S WEALTH IN AGRICULTURE

Agriculture is Oklahoma's number one industry. It has more capital invested and employs more people than any other industry in the state. Farms and ranches alone represent a capital investment of four billion dollars—three billion in land and buildings, one-half billion in machinery and one-half billion in livestock.

Farm income currently amounts to more than $700,000,000 annually. The value added by manufacture of farm products adds another $130,-000,000 annually.

Some 175,000 Oklahomans manage and operate its nearly 100,-000 farms and ranches. Another 14,000 workers are required to keep farmers supplied with production items. Approximately 300,000 full-time employees are engaged by the firms that market and process Oklahoma farm products.

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