Size Adjustments of Alabama Grade A Milk Producers

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CONTENTS

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ALABAMA GRADE A

MILK PRODUCERS*

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A COMMON CHARACTERISTIC of many American industries is
the change toward fewer but larger firms. Because such changes
have far-reaching effects on competition and market structure,
and thus on policy objectives, it is important that they be ana-
lyzed. In recent years, the dairy industry has been characterized
by a sharp decline in numbers of firms producing, processing, and
distributing milk, and by a large increase in the size and output
of remaining firms.

The study reported here was concerned with changes in num-
ber and size of Grade A milk production units in Alabama. The
analysis focused primarily on adjustments made by *individual*
milk producers. Objectives of the study were to summarize
changes in number and size of milk producing firms in Alabama,
and to obtain estimates of number and size of producers and
total milk supply for future time periods.

METHOD OF STUDY

The technique used in measuring the effect of changes in size
of milk producing firms in the State was a Markov process analy-
sis, a procedure used by economists in recent years to study size

changes among firms. This procedure utilizes the assumption that the probability of an individual firm moving from one size class to another is the same in each succeeding time priod. The Markov chain process can describe a large amount of empirical data in a condensed version, and results in a more detailed description of the data than if they were analyzed by standard statistical methods. Since the static theory of the firm is sometimes inadequate in dealing with changes occurring over time, the Markov chain procedure provides a useful tool in making such analyses.

Researchers in Louisiana, North Dakota, and California have used the technique to analyze changes in the market structure of the dairy industry (1, 4, 6). The process has been used in studying income and wage distributions, business concentration, social mobility, and food purchases, as well as size changes of business enterprises.[1]

SOURCES OF DATA

Identification of individual milk producers and volume of sales for each producer licensed by the Alabama Milk Control Board were obtained from the Board for the base-building periods of 1958-1959 and 1963-1964. The base-building periods were the 6 months from September 1 through the last day of February. Sales records were obtained from distributors for unlicensed Alabama Grade A producers and for producers located in adjoining states who sold milk to Alabama distributors. The data resulted in a complete enumeration of Alabama producers supplying milk for fluid consumption within the State and a partial enumeration of out-of-state suppliers.[2] Information about characteristics of Alabama dairymen was obtained from a 1964 survey of 800 Grade A milk producers.

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[1] For a discussion of uses of Markov chains in agricultural economics, see: Judge, G. G., and Swanson, E. R., *Markov Chains: Basic Concepts and Suggested Uses in Agricultural Economics,* Ill. Agr. Expt. Sta. Research Report AERR-49, December 1961.

[2] Some out-of-state milk supplies are from producers who ship directly to the distributors. Other out-of-state supplies are obtained from producer associations or milk handlers who sell milk in large quantities to distributors, some of which is supplied seasonally. Almost all of the former group of producers were enumerated; however, none of the out-of-state producers selling milk through producer associations or bulk milk handlers was included in the analysis. Out-of-state producers included in the study accounted for about one-fourth of milk imports during both periods.

GENERAL TRENDS, 1959-1964

During the 5-year period between 1959 and 1964, many significant changes occurred in the Alabama fluid milk industry. In 1959 there were 1,673 Grade A producers in the State, plus 301 in Mississippi, Tennessee, Florida, and Georgia who were regular suppliers to Alabama markets. Average annual sales of these 1,974 dairymen were approximately 265,600 pounds of milk in 1959.[3] By 1964, producer numbers had declined to 1,231 instate and 163 out-of-state, but average sales had increased to 478,500 pounds annually.

Total Grade A sales to handlers increased at a rate of about 5 per cent a year during this period. Imports accounted for 20 per cent of the milk supplied to Alabama markets in both 1959 and 1964. Out-of-state producers in the study accounted for about one-fourth of these imports in each year.

There are many reasons for changes in size and number of Alabama producers. One of the most important influences causing many dairymen to expand herd size was the adoption of the bulk tank and other modern equipment requiring substantial investment. Most dairymen who were not willing to make these additional investments left the business. Better management practices and an increasing percentage of cows of higher producing breeds have caused production per cow to rise. Advancing age of some dairymen and labor shortages may have forced some producers out of farming, or into beef production or other less intensive enterprises.

Quota provisions in Alabama may also have had an effect on the trend toward fewer but larger dairies. It was apparent in the late 1950's that in some areas there was a "race for base" situation, which no doubt influenced some dairymen to leave the business (7). Later during the period, more liberal quota transfer provisions gave producers who were willing to purchase quotas the opportunity to expand sales at relatively low cost. The windfall gain from selling quota may also have hastened some dairymen's decisions to cease production. Although the quota system used in Alabama is not a barrier to potential new producers, the

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[3] Annual production was estimated by multiplying sales during the base-building periods times two. For the 12-month periods beginning September 1, 1958, and September 1, 1963, 49 per cent and 50 per cent, respectively, of the milk delivered to Alabama handlers was supplied during the base-building periods.

need for base increases initial investment in dairying and probably has caused fewer producers to enter the market (5).

Blend prices may have had some effect on changes in producer numbers and herd size. Average blend prices for the State have remained fairly level, dropping from $5.82 in 1959 to $5.64 in 1962, but rising to $5.87 by 1964. Alabama dairymen operate under an individual handler pool, and blend prices paid by some handlers have varied widely from the State average.

As a result of these and other factors, 839 dairymen, or 42 per cent of those in business in 1959, had ceased selling Grade A milk by 1964. Since only 259 producers entered the market during the same period, there was a net loss of 580 producers.

GENERAL CHARACTERISTICS OF PRODUCERS, 1963

In October 1963 the average Grade A herd in Alabama consisted of 76 cows. Of this number, 59 were being milked and 17 were dry. Deliveries per milk cow averaged 733 pounds during October 1963. The average producer in Alabama was 48 years old and had been in the dairy business for 16 years.

The Holstein breed was found to predominate in most Alabama Grade A herds. About 60 per cent of the herds in the State were mainly Holstein; however, three-fourths of the herds included some Jersey cows. Although sale of milk was the most important source of income in 1963 for most Alabama dairymen, 40 per cent received income from other farm enterprises—mostly cotton and beef production. Only 17 per cent of the dairymen worked at off-farm jobs. Most Alabama milk producers owned all land used in the dairy enterprise, although 43 per cent replied that they rented some land.

Stanchion barns were used by about 70 per cent of the producers, while the remaining 30 per cent used milking parlors. About 40 per cent of the grain feeding systems in the State were either fully or partly mechanized in 1963. More than half of the producers reported use of artificial insemination, and about 40 per cent used production testing. The typical dairymen in the State raised all hay and silage fed, and purchased all grain fed (3).

PRODUCER CHARACTERISTICS AND SIZE CHANGES BY SUPPLY AREAS

In this study the State was divided into three major supply areas, North, Central, and South, Figure 1. Producers were classi-
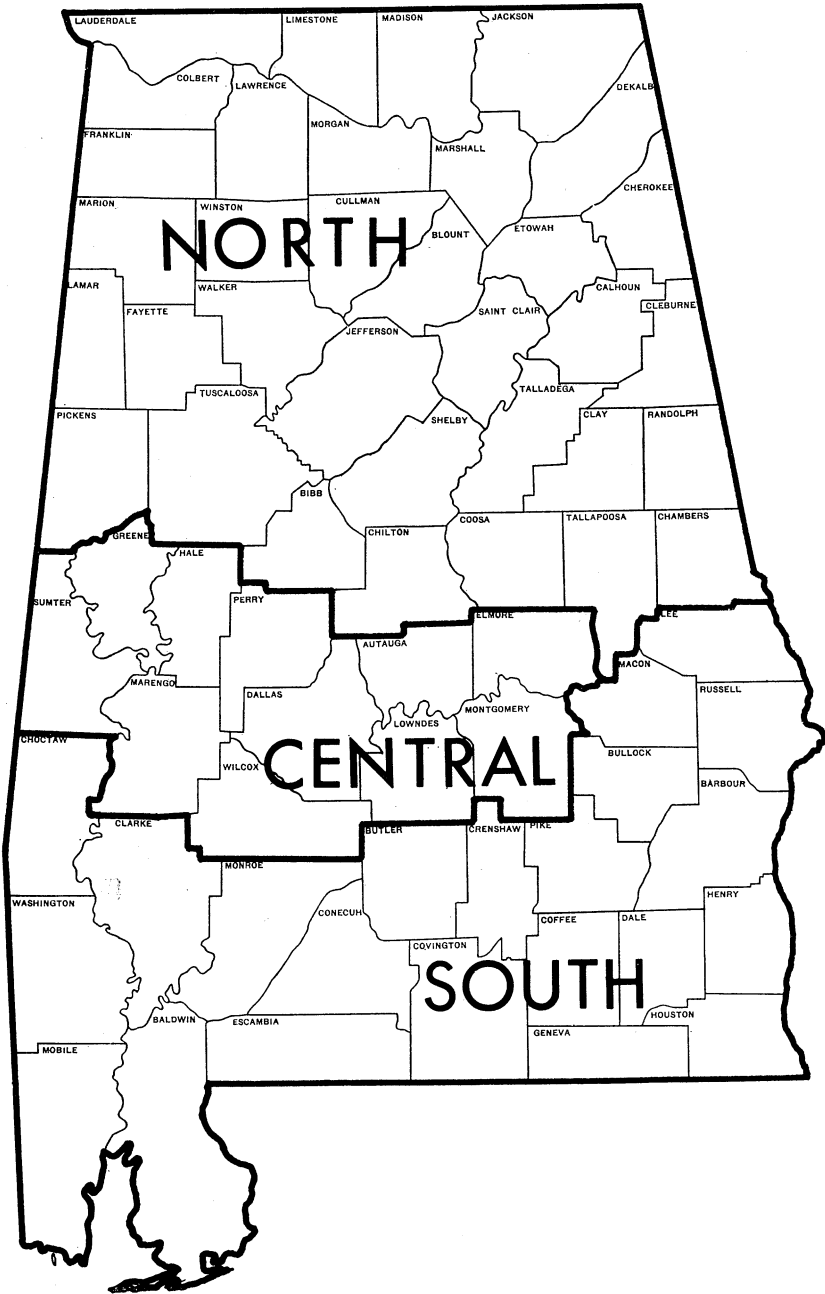
FIG. 1. The map identifies the three milk supply areas used in the study.

TABLE 1. NUMBER OF PRODUCERS, AVERAGE SALES, AND TOTAL SALES OF
PRODUCERS SUPPLYING MILK IN ALABAMA, BY SUPPLY AREAS,
1959 AND 1964

Area	Producers		Average annual sales per producer		Total sales	
	1959	1964	1959	1964	1959	1964
	No.	No.	1,000 lb.	1,000 lb.	1,000 lb.	1,000 lb.
North	827	634	221.6	427.2	183,298	270,814
Central	510	373	402.0	637.0	205,042	237,610
South	336	224	269.5	456.9	90,550	102,348
Total Alabama	1,673	1,231	286.2	496.2	478,890	610,772
Out-of-state	301	163	150.7	345.0	45,360	56,234
TOTAL	1,974	1,394	265.6	478.5	524,250	667,006

fied as to supply areas on the basis of their mailing addresses.
There was much homogeneity within each region regarding size
of farm, types of supplementary or alterative enterprises avail-
able, and geographic characteristics. On the other hand, there
were many differences among the regions regarding volume of
sales, production changes, and producer characteristics. For the
sake of simplicity, all out-of-state producers were grouped to-
gether. Actually, the term "supply group" would provide a more
accurate description of these producers since they were widely
scattered among four adjoining states. Number of producers and
size data are given for the four regions in Table 1.

Definition of Size Categories

Size categories used in the study were based on annual sales,
Table 2. The table may also be used as a general guide for
readers who commonly think of milk production in terms of

TABLE 2. SIZE CATEGORIES USED IN THE STUDY AND CONVERSION OF ANNUAL
SALES TO APPROXIMATE DAILY SALES

Size category	Annual sales	Approximate daily sales
	Pounds	Pounds
O[1]	----	----
A	1- 99,999	1- 274
B	100,000-199,999	275- 549
C	200,000-299,999	550- 824
D	300,000-399,999	825-1,099
E	400,000-599,999	1,100-1,649
F	600,000-799,999	1,650-2,199
G	800,000 and over	2,200 and over

[1] This category was included to provide a reservoir of potential producers, and
it includes producers leaving the business.

daily, rather than annual, deliveries. Because of the wide range in milk sales, it was necessary to select unequal categories. The "0" category must be included for the analysis because producers entered and left the business during the period studied.

North Supply Area

Dairy farms in the North Area can be characterized generally as being smaller than those in the other two supply areas. Average herd size in 1963 was 63 cows, of which 13 were dry. Sales per herd increased from 221,600 pounds annually in 1959 to 427,200 pounds in 1964. There were 827 Grade A dairies in the North Supply Area in 1959 and 634 in 1964.
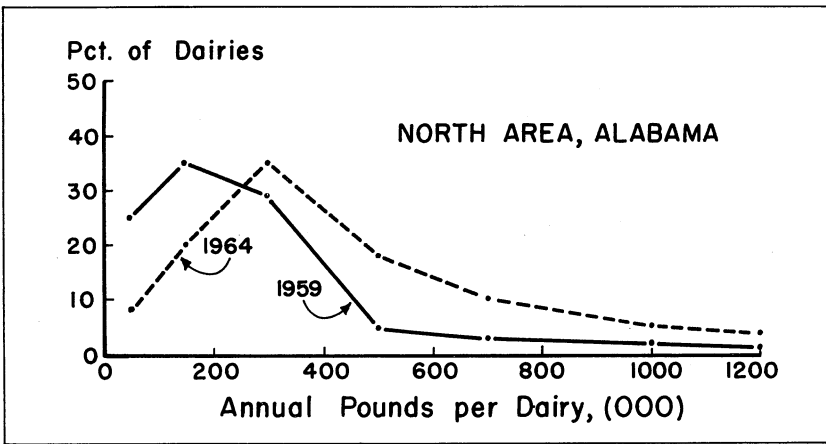
FIG. 2. Changes in size of dairies between 1959 and 1964 in the North Supply Area of Alabama are illustrated by this graph, which shows the percentage in 12 production classes during the two study years.

Figure 2 shows the size distributions of dairies in the North Area in 1959 and 1964. Size changes made by individual producers between the two periods are summarized in Tables 3 and 4.

The two left hand columns of Table 3 list the number of producers in the various size categories in 1959, while the remaining columns give the corresponding numbers in 1964. For example, in 1959 there were 210 dairymen in size category A, the smallest sized firms. By 1964, 129 of these producers had ceased Grade A production, 24 were still in category A, and the remaining 57 dairymen had moved into categories B, C, D, E, and F. Numbers to the right of the diagonal represent producers who increased

TABLE 3. SIZE CHANGES OF GRADE A MILK PRODUCERS, NORTH SUPPLY AREA, ALABAMA, 1959-1964

Size categories	Number of producers in 1959	Producers in each size category in 1964[1]							
		O	A	B	C	D	E	F	G
	No.	No.	No.	No.	No.	No.	No.	No.	No.
O[2]	31,010[3]	30,891	7	25	18	25	25	10	9
A	210	129	24	36	12	5	3	1	0
B	288	102	18	61	49	31	21	4	2
C	163	44	0	6	22	44	35	10	2
D	78	15	0	0	4	7	25	17	10
E	41	11	0	0	1	1	7	13	8
F	25	9	0	0	0	0	2	5	9
G	22	2	0	0	0	0	0	2	18
TOTAL	31,837	31,203[3]	49	128	106	113	118	62	58

827 producers in 1959; after 312 exits and 119 entrants, 1964 total was 634

[1] Numbers to the right of the diagonal represent producers who increased sales between 1959 and 1964; those on the diagonal are producers who made no size class changes during the period; and numbers to the left of the line represent producers who decreased milk sales.

[2] The "O" category represents potential producers. Dairymen who stopped production between 1959 and 1964 are also included under category "O" for 1964.

[3] Total number of commercial farms, less number of Grade A milk producers.

TABLE 4. PERCENTAGE OF PRODUCERS MAKING SPECIFIED SIZE CHANGES, NORTH SUPPLY AREA, ALABAMA, 1959-1964

Size categories in 1959	Percentage shifting to each size category by 1964[1]							
	O	A	B	C	D	E	F	G
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
O	99.6	[2]	0.1	0.1	0.1	0.1	[2]	[2]
A	61.5	11.4	17.1	5.7	2.4	1.4	0.5	0
B	35.4	6.2	21.2	17.0	10.8	7.3	1.4	0.7
C	27.0	0	3.7	13.5	27.0	21.5	6.1	1.2
D	19.2	0	0	5.1	9.0	32.1	21.8	12.8
E	26.8	0	0	2.4	2.5	17.1	31.7	19.5
F	36.0	0	0	0	0	8.0	20.0	36.0
G	9.1	0	0	0	0	0	9.1	81.8

[1] Numbers to the right of the diagonal are proportion of producers shifting to larger categories between 1959 and 1964; those on the diagonal represent proportion remaining in same category; and numbers to the left of the line are proportion who dropped to smaller size categories.

[2] Less than 0.05 per cent.

sales between 1959 and 1964; those on the diagonal are producers who remained within the same class; and numbers to the left of the diagonal show producers who decreased milk sales. The O (no production) category was included to show movements out of the dairy business, as well as to indicate a reservoir of potential entrants into the market. This is the number of commercial farms in the region minus number of Grade A dairies.[4]

The relative movements among size categories in the North Area are given in Table 4. Each row of the table adds to 100 per cent. This table also may be referred to as a "transition probability matrix" and provides the basis for the Markov process. A North Area producer whose annual sales placed him in size category C (200,000-300,000 pounds per year) in 1959 had a 27 per cent probability of being out of business in 1964. His probability of remaining in the same category was only 13 per cent, but his chances of moving up to categories D and E were 27 per cent and 21 per cent, respectively.

In comparison with the other two areas, the North Area dairymen showed a greater tendency toward increased size, particularly among the smaller operations. Average sales per farm increased 93 per cent between 1959 and 1964. This increase was the major factor in allowing the North Area to overtake the Central Region in total milk supplied between 1959 and 1964. Total supplies in the North Supply Area increased 48 per cent, while the statewide increase was only 28 per cent.

Central Supply Area

The 11-county Central Supply Area is composed basically of counties in the Alabama Black Belt. Nearly all soils in the area are naturally adapted to growing grasses and legumes for pasture and forage. Three Black Belt counties, Montgomery, Hale, and Perry, accounted for one-fourth of the total Grade A milk production in the State in 1964. Number of Grade A producers declined from 510 in 1959 to 373 in 1964 for the region.

Average sales per farm in this area were the highest in the State in both periods studied — 402,000 pounds annually in 1959 and 637,000 pounds in 1964. About 23 per cent of the farms in

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[4] The number used to represent the pool of entrants is necessary for the analytical technique used and may be varied widely without appreciably affecting results of the analysis.

FIG. 3. Changes in size of dairies between 1959 and 1964 in the Central Supply Area of Alabama are illustrated by this graph, which shows the percentage in 12 production classes during the two study years.

the Central Area sold more than 800,000 pounds of milk in 1964, Figure 3. Almost two-thirds of these producers sold more than one million pounds annually in 1964. In 1963 average herd size was 102 mature cows.

Size changes of producers are given in Tables 5 and 6. These tables show a high rate of attrition between 1959 and 1964, particularly among the smaller producers. Almost half of the producers in the three smallest size categories quit production during the study period. The dropout rate for the two largest size groups, however, was lower in the Central Region than in the other two areas.

Of the 510 producers in business in 1959, 185 quit producing milk by 1964. On the other hand, only 48 new producers entered the market. Even though average sales per farm were one and a half times as great in 1964 as in 1959, total supplies increased only 16 per cent.

South Supply Area

The South Supply Area had fewest producers and lowest total volume of sales of the three regions. Total sales were 90 million pounds in 1959 and 102 million pounds in 1964. Half of this production was concentrated in 2 of 22 counties in the area. These were the Gulf Coast counties of Baldwin and Mobile. Major farming enterprises in the southern Alabama region are production of peanuts, corn, cotton, and hogs.

TABLE 5. SIZE CHANGES OF GRADE A MILK PRODUCERS, CENTRAL SUPPLY AREA, ALABAMA, 1959-1964

Size categories	Number of producers in 1959	Producers in each size category in 1964[1]							
		O	A	B	C	D	E	F	G
	No.	No.	No.	No.	No.	No.	No.	No.	No.
O[2]	8,940[3]	8,892	1	1	3	7	16	10	10
A	40	27	2	3	5	0	2	1	0
B	87	46	2	7	19	9	3	0	1
C	110	39	2	5	18	23	16	4	3
D	85	21	0	0	4	19	24	11	6
E	110	39	0	1	2	7	21	22	18
F	47	11	0	0	0	1	5	10	20
G	31	2	0	0	0	0	2	1	26
TOTAL	9,450	9,077[3]	7	17	51	66	89	59	84

510 producers in 1959; after 185 exits and 48 entrants, 1964 total was 373

[1] Numbers to the right of the diagonal represent producers who increased sales between 1959 and 1964; those on the diagonal are producers who made no size class changes during the period; and numbers to the left of the line represent producers who decreased milk sales.

[2] The "O" category represents potential producers. Dairymen who stopped production between 1959 and 1964 are also included under category "O" for 1964.

[3] Total number of commercial farms, less number of Grade A milk producers.

TABLE 6. PERCENTAGE OF PRODUCERS MAKING SPECIFIED SIZE CHANGES, CENTRAL SUPPLY AREA, ALABAMA, 1959-1964

Size categories in 1959	Percentage shifting to each size category by 1964[1]							
	O	A	B	C	D	E	F	G
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
O	99.5	[2]	[2]	[2]	0.1	0.2	0.1	0.1
A	67.5	5.0	7.5	12.5	0	5.0	2.5	0
B	52.9	2.3	8.1	21.8	10.3	3.4	0	1.2
C	35.5	1.8	4.5	16.4	20.9	14.6	3.6	2.7
D	24.7	0	0	4.7	22.4	28.2	12.9	7.1
E	35.4	0	0.9	1.8	6.4	19.1	20.0	16.4
F	23.4	0	0	0	2.1	10.6	21.3	42.6
G	6.4	0	0	0	0	6.5	3.2	83.9

[1] Numbers to the right of the diagonal are proportion of producers shifting to larger categories between 1959 and 1964; those on the diagonal represent proportion remaining in same category; and numbers to the left of the line are proportion who dropped to smaller size categories.
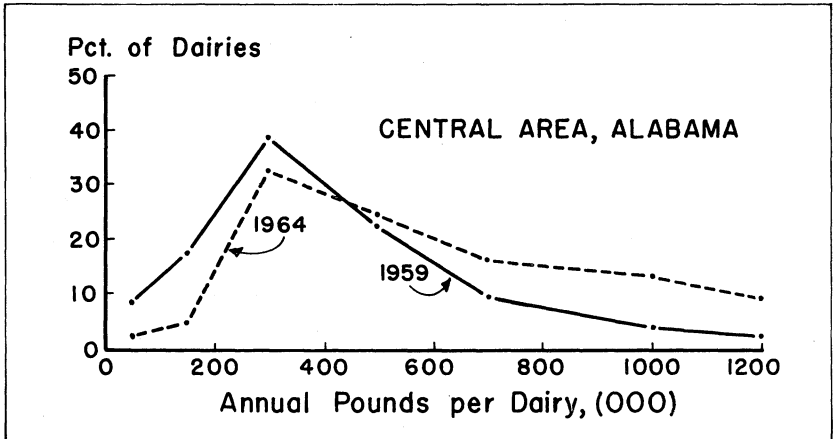
[2] Less than 0.05 per cent.
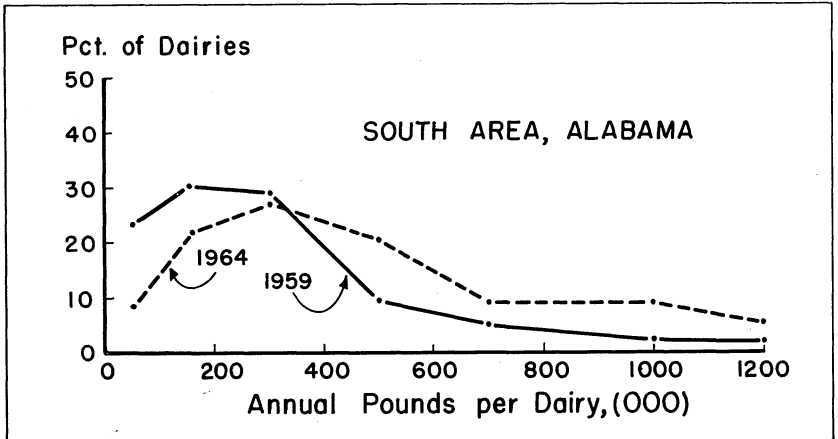
FIG. 4. Changes in size of dairies between 1959 and 1964 in the South Supply Area of Alabama are illustrated by this graph, which shows the percentage in 12 production classes during the two study years.

Dairy farms in the South Area averaged somewhat larger than in the North Area, but were smaller than Black Belt production units. Average production per farm was 269,500 pounds in 1959, but had increased to 456,900 pounds in 1964. Herd sizes in this supply area averaged 61 milking cows and 18 dry cows in October 1963. Figure 4 shows the size distribution curves for South Area producers in 1959 and 1964.

The area's dropout rate was highest of the three regions, Tables 7 and 8. About half of the dairymen in each size class except category G ceased sale of milk in the 5-year period beginning in 1959. However, more than 50 per cent of the producers in 1964 had entered Grade A production since 1959. As a result, producer numbers declined only one-third — from 336 to 224. Average sales per farm increased 70 per cent, yet total supplies increased by only 13 per cent during the study period.

Out-of-State Producers

Few data were available on locations and characteristics of most of the regular out-of-state suppliers to the Alabama market. A large majority of these producers, however, were located in Mississippi, with most of the remainder in Tennessee. Both Tennessee and Mississippi have surplus milk supplies, while Florida and Georgia, like Alabama, are deficit milk producing states.

TABLE 7. SIZE CHANGES OF GRADE A MILK PRODUCERS, SOUTH SUPPLY AREA, ALABAMA, 1959-1964

Size categories	Number of producers in 1959	Producers in each size category in 1964[1]							
		O	A	B	C	D	E	F	G
	No.	No.	No.	No.	No.	No.	No.	No.	No.
O[2]	16,217[3]	16,157	3	10	9	7	14	8	9
A	77	51	11	7	5	0	3	0	0
B	99	49	4	24	10	5	7	0	0
C	61	29	0	7	8	10	4	3	0
D	38	19	0	1	3	2	7	4	2
E	31	15	1	0	0	0	6	4	5
F	17	7	0	0	0	0	2	2	6
G	13	2	0	0	0	0	1	0	10
TOTAL	16,553	16,329[3]	19	49	35	24	44	21	32

336 producers in 1959; after 127 exits and 60 entrants, 1964 total was 224

[1] Numbers to the right of the diagonal represent producers who increased sales between 1959 and 1964; those on the diagonal are producers who made no size class changes during the period; and numbers to the left of the line represent producers who decreased milk sales.

[2] The "O" category represents potential producers. Dairymen who stopped production between 1959 and 1964 are also included under category "O" for 1964.

[3] Total number of commercial farms, less number of Grade A milk producers.

TABLE 8. PERCENTAGE OF PRODUCERS MAKING SPECIFIED SIZE CHANGES, SOUTH SUPPLY AREA, ALABAMA, 1959-1964

Size categories in 1959	Percentage shifting to each size category by 1964[1]							
	O	A	B	C	D	E	F	G
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
O	99.6	[2]	0.1	0.1	[2]	0.1	[2]	0.1
A	66.2	14.3	9.1	6.5	0	3.9	0	0
B	49.5	4.0	24.2	10.1	5.1	7.1	0	0
C	47.5	0	11.5	13.1	16.4	6.6	4.9	0
D	50.0	0	2.6	7.9	5.3	18.4	10.5	5.3
E	48.4	3.2	0	0	0	19.4	12.9	16.1
F	41.1	0	0	0	0	11.8	11.8	35.3
G	15.4	0	0	0	0	7.7	0	76.9

[1] Numbers to the right of the diagonal are proportion of producers shifting to larger categories between 1959 and 1964; those on the diagonal represent proportion remaining in same category; and numbers to the left of the line are proportion who dropped to smaller size categories.
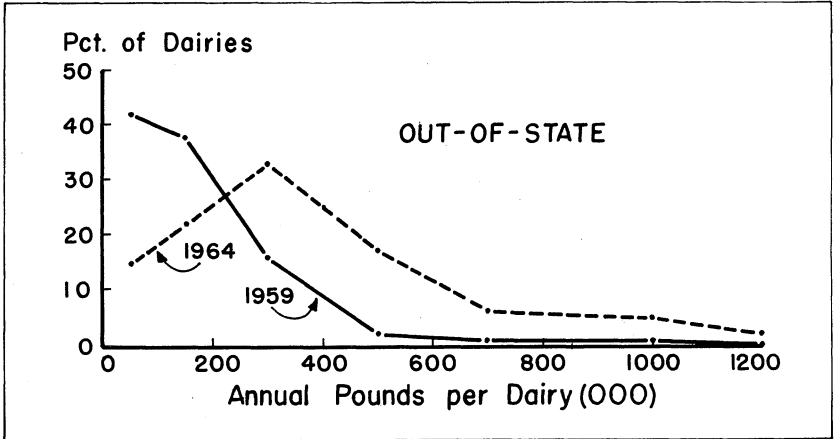
[2] Less than 0.05 per cent.

FIG. 5. Changes in size of out-of-state dairies that shipped milk into Alabama during 1959 and 1964 are illustrated by this graph, which shows the percentage in 12 production classes during the two study years.

Out-of-state producers had the most pronounced shift in size distribution between the two periods, Figure 5. Average sales per production unit were less than those of Alabama producers, 150,700 pounds in 1959 and 345,000 pounds in 1964. A much higher proportion of the out-of-state producers left the market between 1959 and 1964 than was true for Alabama Grade A dairymen. However, it cannot be assumed that all of the dropouts left Grade A milk production. Some may have shifted to markets within their states.

There were 301 out-of-state producers who were identified as suppliers of milk into Alabama in 1959. More than half of these producers no longer supplied milk to Alabama markets in 1964, Tables 9 and 10. Of the 170 dropouts, 152 were in categories A and B (sold less than 200,000 pounds annually). Only 32 out-of-state dairymen entered the market since 1959. Average sales of the entrants were about 70,000 pounds a year more than the average for out-of-state producers who were in dairying both periods. This is in contrast to each of the Alabama supply areas, where market entrants had smaller average sales than old producers.

Total milk supplied by these regular out-of-state shippers increased 24 per cent between 1959 and 1964. In 1959 about 45 million pounds were shipped and in 1964 about 56 million pounds. As stated previously, these shipments accounted for only about 25 per cent of the milk imported into Alabama.

TABLE 9. SIZE CHANGES OF GRADE A MILK PRODUCERS, OUT-OF-STATE
SUPPLIERS, 1959-1964

Size categories	Number of producers in 1959	Producers in each size category in 1964[1]							
		O	A	B	C	D	E	F	G
	No.	No.	No.	No.	No.	No.	No.	No.	No.
O[2]	10,107[3]	10,075	3	7	4	5	5	5	3
A	126	93	16	12	4	1	0	0	0
B	113	59	4	14	13	10	10	3	0
C	37	11	1	2	7	6	6	1	3
D	12	6	0	0	2	1	2	0	1
E	7	0	0	0	0	1	4	1	1
F	2	0	0	0	0	0	0	0	2
G	4	1	0	0	0	1	0	0	2
TOTAL	10,408	10,245[3]	24	35	30	25	27	10	12

301 producers in 1959; after 170 exits and 32 entrants, 1964 total was 163

[1] Numbers to the right of the diagonal represent producers who increased sales between 1959 and 1964; those on the diagonal are producers who made no size class changes during the period; and numbers to the left of the line represent producers who decreased milk sales.

[2] The "O" category represents potential producers. Dairymen who stopped production between 1959 and 1964 are listed under category "O" for 1964.

[3] Total number of commercial farms, less number of Grade A milk producers. For the out-of-state area, this was computed on the basis that proportion of farmers to Grade A producers was the same as was found in Alabama.

TABLE 10. PERCENTAGE OF PRODUCERS MAKING SPECIFIED SIZE CHANGES,
OUT-OF-STATE PRODUCERS, 1959-1964

Size categories in 1959	Proportion shifting to each size category by 1964[1]							
	O	A	B	C	D	E	F	G
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
O	99.7	[2]	0.1	[2]	[2]	0.1	0.1	[2]
A	73.8	12.7	9.5	3.2	.8	0	0	0
B	52.2	3.5	12.4	11.5	8.9	8.9	2.6	0
C	29.8	2.7	5.4	18.9	16.2	16.2	2.7	8.1
D	50.0	0	0	16.7	8.3	16.7	0	8.3
E	0	0	0	0	14.3	57.1	14.3	14.3
F	0	0	0	0	0	0	0	100.0
G	25.0	0	0	0	25.0	0	0	50.0

[1] Numbers to the right of the diagonal are proportion of producers shifting to larger categories between 1959 and 1964; those on the diagonal represent proportion remaining in same category; and numbers to the left of the line are proportion who dropped to smaller size categories.

[2] Less than 0.05 per cent.

PROJECTIONS OF PRODUCER NUMBERS
AND SIZE DISTRIBUTIONS

Projections of future size distributions of milk producers were obtained by using the Markov chain process. Tables 3 through 10 record the basic input data for the procedure. It is necessary to make the following assumptions regarding the projections: (1) price and production relationships existing in the base period will continue to exist in the future; (2) producers will continue to react similarly to the given relationships; and (3) locational advantages and disadvantages of producers within each of the supply areas will remain constant. Assumptions 1 and 2, however, are no different from those that must be made when projecting any trend based on past occurrences. Assumption 3 limits

TABLE 11. NUMBER OF MILK PRODUCERS PER SIZE CATEGORY, BY SUPPLY AREAS, ALABAMA, 1959 AND 1964, AND PROJECTIONS FOR 1969 AND 1974

Year and supply area	Producers in each size category							Total
	A	B	C	D	E	F	G	
	No.	No.	No.	No.	No.	No.	No.	No.
North								
1959	210	288	163	78	41	25	22	827
1964	49	128	106	113	118	62	58	634
1969	21	65	66	82	119	98	119	570
1974	13	45	46	61	99	101	176	541
Central								
1959	40	87	110	85	110	47	31	510
1964	7	17	51	66	89	59	84	373
1969	3	6	21	41	72	54	126	323
1974	1	3	11	27	59	46	154	301
South								
1959	77	99	61	38	31	17	13	336
1964	19	49	35	24	44	21	32	224
1969	9	28	22	17	38	20	49	183
1974	7	21	17	13	35	19	61	173
Total Alabama								
1959	327	474	334	201	182	89	66	1,673
1964	75	194	192	203	251	142	174	1,231
1969	33	99	109	140	229	172	294	1,076
1974	21	69	74	101	193	166	391	1,015
Out-of-state								
1959	126	113	37	12	7	2	4	301
1964	24	35	30	25	27	10	12	163
1969	8	15	19	22	33	11	27	135
1974	5	11	13	23	32	11	35	130
Total suppliers								
1959	453	587	371	213	189	91	70	1,974
1964	99	229	222	228	278	152	186	1,394
1969	41	114	128	162	262	183	321	1,211
1974	26	80	87	124	225	177	426	1,145

conclusions regarding changes in milk production in a particular supply area in relation to changes occurring in other areas.

Projections of producer numbers are summarized by supply areas in Table 11. Producer numbers in Alabama are projected to decline about 20 per cent by 1974. The projections indicate a net decline from 1964 of 93 producers in the North Area, 72 in the Central Area, and 51 in the South Supply Area. Summarized in Table 12 are projected changes in numbers of producers and annual sales per producer by Alabama regions and out-of-state suppliers.

TABLE 12. NUMBER OF PRODUCERS AND AVERAGE ANNUAL SALES PER PRODUCER, 1964 AND 1974 PROJECTIONS, ALABAMA AND OUT-OF-STATE

Supply area	Number of producers		Average annual sales per producer	
	1964	1974	1964	1974
	No.	*No.*	*1,000 lb.*	*1,000 lb.*
North	634	541	427.2	746.0
Central	373	301	637.0	1,036.2
South	224	173	456.9	765.3
Alabama total	1,231	1,015	496.2	835.4
Out-of-state	163	130	345.0	590.0
TOTAL	1,394	1,145	478.5	807.5

Numbers of producers shipping less than 400,000 pounds (categories A-D) are expected to decline greatly in all regions. This decrease by 1974 is expected to be 74 per cent of suppliers in category A, 65 per cent in category B, 61 per cent in class C, and 46 per cent in category D. Number of producers in category E (400,000-600,000 pounds per year) is also expected to decrease, although not as drastically as in the smaller size classifications. In the case of size category F, producer numbers are expected to increase by 31 in 1969 followed by a small decrease during the following 5 years.

Offsetting the drop in producer numbers in the smaller categories will be a great increase in number of producers in the largest size category. The projections call for an increase of 240 producers in category G by 1974. About half of this increase will be accounted for by North Area producers.

Percentage distribution of producers among size categories is also expected to change markedly within the next decade, Table 13. In 1959, one-fifth of Alabama producers were in the smallest size group. Percentage of dairymen in this class declined to 6

TABLE 13. PERCENTAGE OF MILK PRODUCERS PER SIZE CATEGORY, BY SUPPLY
AREAS, ALABAMA, 1959 AND 1964, AND PROJECTIONS FOR 1969 AND 1974

Year and supply area	Percentage of producers in each size category							Total
	A	B	C	D	E	F	G	
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
North								
1959	25	35	20	9	5	3	3	100
1964	8	20	17	18	18	10	9	100
1969	4	11	12	14	21	17	21	100
1974	2	8	9	11	18	19	33	100
Central								
1959	8	17	22	16	22	9	6	100
1964	2	4	14	18	24	16	22	100
1969	1	2	6	13	22	17	39	100
1974	1	1	4	9	20	15	51	100
South								
1959	23	30	18	11	9	5	4	100
1964	8	22	16	11	20	9	14	100
1969	5	15	12	9	21	11	27	100
1974	4	12	10	8	20	11	35	100
Total Alabama								
1959	20	28	20	12	11	5	4	100
1964	6	16	16	16	20	12	14	100
1969	3	9	10	13	21	16	28	100
1974	2	7	7	10	19	16	39	100
Out-of-state								
1959	42	38	12	4	2	1	1	100
1964	15	22	18	15	17	6	7	100
1969	6	11	14	16	25	8	20	100
1974	4	8	10	18	25	8	27	100
Total								
1959	23	30	19	11	10	4	3	100
1964	7	17	16	16	20	11	13	100
1969	3	9	11	13	22	15	27	100
1974	2	7	8	11	20	15	37	100

[1] Less than 0.5 per cent.

per cent in 1964 and is projected to drop to only 2 per cent within
10 years. The proportion of producers whose sales place them in
categories B-D likewise will decline by 1974.

Percentage of dairymen in size category E will remain almost
constant. A slightly higher percentage of producers is projected
for category F group (600,000-800,000 pounds per year). By 1974
it is anticipated that almost 40 per cent of the Alabama producers
will be included in the largest size class (over 800,000 pounds
annually), up from 4 per cent in 1959.

SUPPLY PROJECTIONS

Method of Making Projections

One of the useful features of an analysis that projects size distributions for future periods is that estimates of future supplies can be obtained. Supply estimates were calculated by multiplying average sales per producer in each size category by the projected number of producers within that size category and obtaining a total. For categories B-F, the midpoint of each size category was used. The actual average sales of producers within each size classification were computed for 1959 and 1964 and it was found that averages within these groups were clustered around the midpoint. For size category A (up to 100,000 pounds annually), average yearly production was assumed to be 60,000 pounds. Average production for dairies in this group was around 60,000 pounds in both 1959 and 1964. Milk supplied by producers in size category A, however, is expected to have little effect on total supplies.

There was a problem in computing averages for the open-end category, G. In 1959 and 1964 average sales of all Alabama dairymen in this category were almost identical, about 1,340,000 pounds annually in both years. However, average sales of category G producers located in the Central and South Areas declined during the period, while average in the North Area increased from 1,175,000 pounds in 1959 to 1,410,000 pounds in 1964.

Average size of the large producers in 1969 and 1974 was estimated by assuming a 20 per cent increase in sales every 5 years for producers already in class G at the beginning of the period. Then, number of producers expected to enter Class G from lower classes was calculated from the transition matrices. Average size of producers entering category G from lower size classifications was assumed to be a function of the size category in the earlier period, e.g., producers who enter class G from class F will be larger on the average than producers who enter from category E, D, C, B, or A. Annual average sales for 1969 and 1974 obtained in this manner were as follows:

Supply area	1964	Average annual sales of producers in size category G 1969	1974
		1,000 pounds	
North	1,412	1,332	1,380
Central	1,352	1,417	1,541
South	1,230	1,330	1,460
Out-of-state	1,167	1,100	1,140

Projected Supplies in 1969 and 1974

Estimated supplies produced within the State are projected to be about 730 million pounds in 1969 and almost 850 million pounds in 1974, Table 14. By 1974 it is anticipated that 48 per cent of the Grade A milk produced in Alabama will be produced in the North Supply Area, 37 per cent in the Central Area, and 15 per cent in the South Area. The out-of-state producers included in the study were expected to supply about 77 million pounds by 1974.

Supplies in 1969 and 1974 were also estimated by the method of least squares using records of the Alabama Milk Control Board.

TABLE 14. ANNUAL VOLUME OF MILK SOLD PER SIZE CATEGORY, BY SUPPLY AREAS, ALABAMA, 1959 AND 1964, AND PROJECTIONS FOR 1969 AND 1974

Year and supply area	Annual milk sales by size category							Total[1]
	A	B	C	D	E	F	G	
	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.
North								
1959	13.6	41.0	39.6	26.7	19.6	17.0	25.8	183.3
1964	3.7	19.4	25.5	38.8	58.6	42.9	81.9	270.8
1969	1.3	9.8	16.5	28.7	59.5	68.6	158.5	342.9
1974	.8	6.8	11.5	21.4	49.5	70.7	242.9	403.6
Central								
1959	2.4	13.1	27.4	29.6	53.7	32.2	46.6	205.0
1964	.6	2.6	12.6	22.9	44.2	41.1	113.6	237.6
1969	.2	.9	5.3	14.4	36.0	37.8	178.5	273.1
1974	.1	.5	2.8	9.5	29.5	32.2	237.3	311.9
South								
1959	4.7	14.4	14.9	13.2	14.9	11.7	16.7	90.5
1964	1.3	7.8	8.5	8.3	22.4	14.6	39.4	102.3
1969	.5	4.2	5.5	6.0	19.0	14.0	65.2	114.4
1974	.4	3.2	4.3	4.6	17.5	13.3	89.1	132.4
Total Alabama								
1959	20.7	68.5	81.9	69.5	88.2	60.9	89.1	478.8
1964	5.6	29.8	46.6	70.0	125.2	98.6	234.9	610.7
1969	2.0	14.9	27.3	49.1	114.5	120.4	402.2	730.4
1974	1.3	10.5	18.6	35.5	96.5	116.2	569.3	847.9
Out-of-state								
1959	7.8	15.5	9.1	4.2	3.1	1.4	4.2	45.3
1964	1.3	5.1	7.5	8.5	13.1	6.6	14.0	56.1
1969	.5	2.2	4.8	7.7	16.5	7.7	29.7	69.1
1974	.3	1.6	3.2	8.0	16.0	7.7	39.9	76.7
Total sales								
1959	28.5	84.0	91.0	73.7	91.3	62.3	93.3	524.1
1964	6.9	34.9	54.1	78.5	138.3	105.2	248.9	666.8
1969	2.5	17.1	32.1	56.8	131.0	128.1	431.9	799.5
1974	1.6	12.1	21.8	43.5	112.5	123.9	609.2	924.6

[1] Because of rounding error, some totals for 1959 and 1964 do not precisely agree with those given in Table 1.

The equation used in estimating future supplies was $Y_c =$ 506,943,000 + 22,882,000X, using 1959 as a base, with X = one year. Projected Alabama produced supplies were estimated by this method to be 735,763,000 pounds in 1969 and 850,173,000 pounds in 1974. These figures are almost identical with the projections given in Table 14. This similarity of estimates gives confidence to the results obtained by the Markov process technique.

The key role of the largest producers in Alabama's dairy industry is further shown in Table 15. By 1974, more than two-thirds of the milk produced in Alabama will be by dairymen in size category G. On the other hand, less than 10 per cent of Alabama supplies will come from all producers in categories A, B, C, and D. The largest producers will have the greatest rela-

TABLE 15. PERCENTAGE OF MILK SUPPLIED PER SIZE CATEGORY, BY SUPPLY AREAS, ALABAMA, 1959 AND 1964, AND PROJECTIONS FOR 1969 AND 1974

Year and supply area	Percentage of supplies from each size category							Total
	A	B	C	D	E	F	G	
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
North								
1959	7.4	22.3	21.6	14.6	10.7	9.3	14.1	100.0
1964	1.4	7.2	9.4	14.3	21.7	15.8	30.2	100.0
1969	.4	2.9	4.8	8.4	17.3	20.0	46.2	100.0
1974	.2	1.7	2.8	5.3	12.3	17.5	60.2	100.0
Central								
1959	1.2	6.4	13.4	14.4	26.2	15.7	22.7	100.0
1964	.3	1.1	5.3	9.6	18.6	17.3	47.8	100.0
1969	.1	.3	1.9	5.3	13.2	13.8	65.4	100.0
1974	1	.2	.9	3.0	9.5	10.3	76.1	100.0
South								
1959	5.2	15.9	16.5	14.6	16.5	12.9	18.4	100.0
1964	1.3	7.6	8.3	8.1	21.9	14.3	38.5	100.0
1969	.4	3.7	4.8	5.3	16.6	12.2	57.0	100.0
1974	.3	2.4	3.3	3.5	13.2	10.0	67.3	100.0
Total Alabama								
1959	4.3	14.4	17.1	14.5	18.4	12.7	18.6	100.0
1964	.9	4.9	7.6	11.5	20.5	16.1	38.5	100.0
1969	.3	2.0	3.7	6.7	15.7	16.5	55.1	100.0
1974	.2	1.2	2.2	4.2	11.4	13.7	67.1	100.0
Out-of-state								
1959	17.2	34.2	20.1	9.3	6.8	3.1	9.3	100.0
1964	2.3	9.1	13.4	15.1	23.3	11.8	25.0	100.0
1969	.7	3.2	7.0	11.1	23.9	11.1	43.0	100.0
1974	.4	2.1	4.2	10.4	20.9	10.0	52.0	100.0
Total								
1959	5.4	16.0	17.4	14.1	17.4	11.9	17.8	100.0
1964	1.0	5.2	8.1	11.8	20.8	15.8	37.3	100.0
1969	.3	2.2	4.0	7.1	16.4	16.0	54.0	100.0
1974	.2	1.3	2.3	4.7	12.2	13.4	65.9	100.0

[1] Less than 0.1 per cent.

tive importance in the Central Supply Area, supplying three-fourths of the milk in that region.

If it is assumed that the out-of-state producers included in the study continue to account for 25 per cent of all imports, total imports will amount to about 307 million pounds in 1974. Thus, total supplies would be expected to amount to around 1,155 million pounds annually.

Supply-Demand Balance

Based on a recent study of the demand for fluid milk in the South, consumption estimates were obtained for Alabama in 1974 as follows: (2)

Projected levels	Demand for fluid products	Demand for non-fluid products	Total demand[5]
		Million pounds	
Low	851.8	168.7	1,020.5
High	949.1	170.9	1,120.0

Alabama produced supplies will be about adequate, disregarding seasonality of milk supplies and demand, to meet the projected low level of demand for fluid products only. If total imports continue to be in the same proportion to imports from out-of-state producers studied, then supplies in 1974 should be adequate to fulfill either the high or low level of aggregate demand.

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[5] Demand estimates were adjusted downward from 1975 to obtain a 1974 estimate. Consumption estimates shown were calculated using a fat solids basis. Aggregate demand was based on a low level per capita demand of 232.8 pounds and 46.1 pounds for fluid and non-fluid products, respectively, and high level was based on a per capita demand of 259.4 pounds and 46.7 pounds.

SUMMARY AND CONCLUSIONS

Number of Grade A milk producers in Alabama declined from 1,673 in 1959 to 1,231 in 1964. Number of out-of-state producers included in this study who were regular suppliers to Alabama markets dropped 46 per cent, from 301 to 163, during the same period. Average annual sales per producer increased markedly during the study period, from 265,600 pounds in 1959 to 478,500 pounds in 1964. The net result of these two trends was an increase in total milk supplied by the producers studied from 524 million pounds in 1959 to 667 million pounds in 1964.

Size changes of individual producers in each of the four supply areas were characterized by the following:

1. Producers in the smaller size categories had the highest probability of leaving the business.

2. A relatively low percentage of producers in each size category with the exception of the largest, category G, stayed in the same category for both periods.

3. Decreases in size, except for exits, were uncommon.

4. Most increases in sales were small, with producers moving up by only one or two categories (moving one or two columns to the right of the diagonal in Tables 3-10). Large increases in size were uncommon.

5. Only 10 per cent of the largest suppliers (over 800,000 pounds per year) left the business between 1959 and 1964.

Greatest tendency toward increased size was exhibited by producers in the North Area. Highest mobility into and out of the business was in the South Region. Central Area producers in the two largest size categories (over 600,000 pounds annually) were less likely to leave the business and more likely to increase volume of sales than the largest producers in the other regions.

Projections call for a continuing decline in number of producers and a continuing increase in average sales. On the basis of the projections, it appears that Alabama will continue to rely heavily on imports to meet the demand for fluid milk. Alabama produced supplies, disregarding seasonality of demand and production, will be adequate to meet only the low level of projected demand for fluid products. However, if quantities imported in 1974 are in proportion to supplies from out-of-state producers studied in 1959 and 1964, there should be adequate milk to meet the

projected high level demand for both fluid and non-fluid products in the State.

IMPLICATIONS

Because of changes in price, technology, and market organization, dairymen evaluate their operations and adjust their production units to increase profits (or reduce losses). In recent years individual Alabama producers have commonly adjusted to changes by either rapidly expanding sales or by leaving the dairy business. These adjustments, brought about by a dynamic market situation, have important implications for the industry. One question in this regard is the determination of the optimum size of production units under given price and technology situations. This analysis was not designed to determine optimum size of production units; however, farm management studies at Auburn University Agricultural Experiment Station concerning costs and returns of Grade A dairy operations should provide such information.

Although supply projections made in this study call for a continuing increase in size of milk producing units, at some point there will probably be a "leveling off" in herd sizes. If Alabama dairymen are able to expand to sizes now being reached by producers in southeastern Florida, it may be assumed that adequate supplies can be produced in the State. Economic studies in some Southern States, however, have implied that the point of diminishing returns to scale may occur at herd sizes already reached by many Alabama dairymen.

Development of producer cooperatives and bargaining associations in Alabama has lagged far behind cooperative efforts of other states. In view of the trend toward fewer but larger production units, Alabama dairymen are likely to find cooperative marketing of milk a feasible alternative. Many producer cooperatives handle the entire procurement operation, including management of surplus and other marketing services.

It appears unlikely that Alabama will become a self-sufficient milk producing state within the next decade. Continued sales expansion by Alabama dairymen is needed to meet the expected demand for 1974 and to prevent milk shortages — especially seasonal deficits. Otherwise, the State may become increasingly dependent on out-of-state supplies.

It is doubtful that increased supplies will be forthcoming from entrants into the market, because of several reasons. One is that current quota regulations tend to restrict entries. In addition, this study has brought out the fact that a high rate of failure exists for small production units. Large firms exhibited a greater survival tendency; however, the sizeable investment required to enter the Grade A market at a large size will probably be a deterring factor for potential new producers.

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APPENDIX

NUMBER OF GRADE A MILK PRODUCERS, ESTIMATED TOTAL SALES, AND ESTIMATED SALES PER PRODUCER, BY COUNTIES, 1959 AND 1964[1]

County	Number of producers		Average sales		Total sales	
	1959	1964	1959	1964	1959	1964
	No.	No.	1,000 lb.		1,000 lb.	
Autauga	6	6	209.3	353.3	1,256	2,120
Baldwin	86	61	241.6	390.4	20,776	23,814
Bibb	1	4	746.0	624.0	746	2,496
Blount	19	16	328.1	780.0	6,234	12,480
Bullock	6	4	253.3	339.0	1,520	1,356
Butler	10	5	253.6	486.4	2,538	2,432
Calhoun	63	45	152.7	270.7	9,620	12,182
Chambers	17	11	289.8	498.9	4,926	5,488
Cherokee	13	8	210.6	529.0	2,738	4,232
Chilton	16	15	302.8	417.6	4,844	6,264
Clay	18	17	147.0	276.0	2,646	4,692
Cleburne	5	5	134.8	175.2	674	876
Coffee	13	8	164.9	434.5	2,144	3,476
Colbert	9	8	144.0	362.2	1,296	2,898
Conecuh	10	8	245.8	448.7	2,458	3,590
Covington	5	3	80.4	268.7	402	806
Crenshaw	3	3	490.7	178.7	1,472	536
Cullman	31	24	143.6	294.1	4,452	7,058
Dale	5	3	280.4	735.3	1,402	2,206
Dallas	70	50	347.5	549.2	24,324	27,458
DeKalb	28	36	177.9	382.6	4,980	13,772
Elmore	39	31	404.6	831.3	15,778	25,770
Escambia	5	10	468.4	473.2	2,342	4,732
Etowah	29	28	240.0	420.8	6,960	11,782
Fayette	19	19	146.7	312.2	2,788	5,932
Franklin	12	9	263.2	388.4	3,158	3,496
Geneva	14	9	142.0	383.8	1,988	3,454
Greene	9	10	237.3	448.0	2,136	4,480
Hale	116	84	328.7	513.1	38,132	43,104
Henry	3	4	190.0	460.5	570	1,824
Houston	15	10	290.4	569.2	4,356	5,692
Jackson	18	18	177.8	283.9	3,200	5,110
Jefferson	57	41	489.1	840.8	27,876	34,472
Lamar	23	15	112.3	175.5	2,582	2,632
Lauderdale	11	10	298.2	729.8	3,280	7,298
Lawrence	11	10	254.4	571.4	2,798	5,714
Lee	25	12	323.6	576.3	8,090	6,916
Limestone	58	38	150.2	279.2	8,712	10,610
Lowndes	34	23	327.3	459.1	11,128	10,560
Macon	11	6	237.6	353.7	2,614	2,122
Madison	42	34	167.4	318.5	7,030	10,830
Marengo	44	29	533.6	512.8	23,478	14,872
Marion	13	11	161.4	343.5	2,098	3,778
Marshall	19	17	162.6	268.4	3,090	4,562
Mobile	94	63	259.0	436.1	24,346	27,476
Montgomery	129	87	490.5	830.5	63,276	72,250
Morgan	36	26	183.2	349.5	6,596	9,088
Perry	62	52	410.4	709.6	25,442	36,898

(Continued)

NUMBER OF GRADE A MILK PRODUCERS, ESTIMATED TOTAL SALES, AND ESTIMATED SALES PER PRODUCER, BY COUNTIES, 1959 AND 1964[1] *(Continued)*

County	Number of producers		Average sales		Total sales	
	1959	1964	1959	1964	1959	1964
	No.	*No.*	*1,000 lb.*		*1,000 lb.*	
Pickens	47	26	133.1	357.2	6,254	9,288
Pike	9	4	211.6	303.5	1,904	1,214
Randolph	8	5	149.8	354.4	1,198	1,772
Russell	19	9	598.6	1,111.7	11,374	10,006
St. Clair	26	16	212.4	413.1	5,522	6,610
Shelby	56	43	375.2	747.5	21,010	32,144
Talladega	40	25	272.0	443.7	10,880	11,092
Tallapoosa	15	12	241.1	358.5	3,616	4,302
Tuscaloosa	34	21	210.9	369.7	7,172	7,764
Walker	11	11	122.2	443.5	1,344	4,878
Winston	18	8	125.1	578.0	2,252	4,624
Others[2]	8	5	134.0	278.4	1,072	1,392
TOTAL	1,673	1,231	286.2	496.2	478,890	610,772

[1] Based on sales during base-building periods of 1958-1959 and 1963-1964.

[2] Barbour, Coosa, Monroe, and Sumter counties. There were no Grade A dairies reported in either period for Choctaw, Clarke, Washington, and Wilcox counties.