



CHANGES IN FARM MILK SHIPMENTS IN THE DETROIT MILKSHED
AS RELATED TO BULK HANDLING

By

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AN ABSTRACT

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ABSTRACT

The adoption of bulk handling is one of the most important and far-reaching changes taking place in dairying today. This study investigates changes taking place in the volume of milk shipments from individual farms supplying the Detroit market as these farms adopt bulk methods of cooling and shipping milk.

The records of present producers supplying the Detroit market who were shipping milk in bulk by the end of 1956 were obtained from Michigan Milk Producers' Association. These records showed annual shipments made by individual farms, based on the Association fiscal years ending on September 30 of 1955, 1956, 1957, and 1958. Records were also obtained from a 5% sample of shippers who continue at present to ship milk in cans.

The results show that two-thirds of the can shippers and four-fifths of the bulk shippers increased shipments more than 10% during the period of the study. Annual mean volume for bulk shippers increased from 192,422 pounds in 1955 to 258,737 pounds in 1958, or 35%. During the same period means for can shippers increased from 13,150 pounds to 150,318 pounds, or only 13%. The greatest increase was in 1957, the first full year of bulk shipments, which was 14.6% above the previous year.

The study also shows that mean volumes of shipment increased 70% during the period of the study in the smallest size class for each shipment method, which was 0 to 50,000 pounds for can shipment and 50,000 to 100,000 pounds for bulk shipment. The rates of increase dropped sharply in the larger size classes.

The 50,000 to 100,000-pound can group increased shipments only 18%. This indicates that small shippers who are expanding remain with cans, while the next larger group of shippers who expand markedly tend to adopt bulk handling.

The adoption of bulk handling on farms is associated with an increase in milk shipments which is significantly greater than the increase from can shippers. This significantly greater increase in shipments may be a factor in making the present surplus and price problems more serious. During the year of 1958 total shipments in the Detroit market increased 9.3%, but came from 6.5% fewer shippers.

The adoption of bulk handling is not considered to be the cause of larger shipments. Rather, these two factors are considered to be a part of greater changes affecting the dairy industry.

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the Detroit office of Michigan Milk Producers' Association were very helpful in making data available; all personnel were most cooperative and friendly. Hugh Moore's study at Wisconsin was a light in the darkness.

An immeasurable extent of the value of graduate work comes from interaction with other graduate students. Thanks are due to J. Paxton Marshall who first suggested the topic; John Lu who patiently tried to supplement the author's statistical understanding; and Darrell Flaunt and all others who were sources of information and encouragement, as well as sounding boards for ideas.

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CHAPTER I

INTRODUCTION

This study investigates the direction and magnitude of changes in milk supplies from individual farms as these changes relate to the adoption of one of the important technological innovations taking place on our dairy farms. This innovation is the adoption of large refrigerated holding tanks on dairy farms, replacing the traditional ten-gallon milk can and mechanical cooler or water tank. While the basic change is on the farm, its effects are felt throughout the entire milk industry.

The Setting of the Problem

Dairy farmers are very much affected by the current cost-price squeeze in agriculture. With high fixed costs and specialized investments, the dairy farmer often finds it difficult to shift to alternative enterprises. With narrowing margins per unit of output he finds it necessary to achieve both efficiency and volume in order to maintain earnings.

The Dairy Picture in Michigan

Michigan ranks seventh among states in the number of milk cows two years old and older.¹ In terms of cash receipts,

¹Michigan Agricultural Statistics, Michigan Department of Agriculture, July, 1958, p. 7.

dairying is the most important type of farming in the state. In 1957, 28% of all cash farm receipts were from dairy products.²

The number of milk cows on farms has been steadily declining since 1953, decreasing from 847,000 cows in 1953 to 781,000 in 1957. However, increasing production per cow, from 6,500 pounds in 1953 to 6,960 pounds in 1957, has approximately maintained total milk supplies.³

Technological Changes on the Dairy Farm

Dairying has been involved in change and improvement over the years as have other types of farming. The adoption of milking machines, production testing, and artificial insemination are but a few of the fairly recent changes which have been adopted by dairy farmers. More recently, loose housing barns and milking parlors have largely replaced stanchion barns in new construction. Recently, herringbone type parlors have come into use. The first herringbone system in Michigan was completed in November, 1957. It is estimated that by the end of 1958 there were at least 80 herringbone systems in Michigan, either in operation or in some stage of construction.⁴

²Ibid., p. 11.

³Ibid., p. 41.

⁴C. R. Hoglund, J. S. Boyd and W. W. Snyder, "Herringbone and Other Milking Systems", Article 41-75, Quarterly Bulletin of the Agricultural Experiment Station, Vol. XII, No. 3 (February, 1959), p. 719.

Bulk Handling

One of the most wide-spread and far-reaching factors to date in this technological revolution has been the adoption of bulk handling of milk. With bulk handling, milk is placed in a large refrigerated holding tank immediately after milking. In many installations milk is piped from the cow directly into the tank. Two or four milkings are accumulated in the tank before the milk is picked up by a tank truck. The hauler checks the milk for off-flavors, samples and measures it, and pumps it into the tank truck.

The adoption of bulk handling

The adoption of bulk handling has proceeded rapidly in all parts of the country. Since 1950 the number of bulk tanks on American farms has approximately doubled each year.

During January, 1958, 47% of the total receipts in 67 of the 68 Federal Order markets came from the 32% of producers in these markets having bulk tanks. During the preceding January 33% of the milk in 64 order markets came from bulk tanks. In January, 1956, 17.4% of total milk deliveries in 53 markets came from bulk tanks.⁵

The above survey showed that in all markets but one average shipments for bulk producers were larger than for can shippers. In one market the average bulk producer shipped 257% as

⁵Ellen A. Henderson, Survey of Bulk Milk Tanks on Farms of Producers Marketing Milk in Federal Order Markets, January, 1958, AMS-261, Dairy Division, Agricultural Marketing Service, USDA (undated), pp. 1 and 6.

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much milk as the can shipper. For the 67 markets average daily bulk delivery was 764 pounds, compared with 412 pounds in cans.⁶ This indicates that bulk handling tends to be adopted by large shippers.

Impact of Bulk Handling on the Dairy Industry

The impact of bulk handling on the dairy industry is well summarized by the following statement from the Agricultural Marketing Service of the United States Department of Agriculture.

The ever-increasing quantities of milk moving from bulk farm tanks to milk plants throughout the United States have brought important changes to the dairy industry and important problems to be dealt with. It is difficult to evaluate these developments and to foresee the full scope of changes and problems which may be expected in the future. However, experience to date suggests a few possibilities. Boundaries of individual markets may expand and overlap each other because the bulk handling system enables the milk to be moved farther, at lower transportation rates, and more rapidly, thus maintaining better quality. The flexibility of a milk supply which may be diverted directly from the farm to the sales area where it is needed on a particular day may tend to develop a more uniform price among markets. Local markets are less isolated from new milk supplies by the distance barrier. Country assembly plants are disappearing. Many dairy farmers are finding it necessary to convert their facilities in order to retain a market as can receiving stations and plants go to 100% bulk handling. As this flexible system allows for more day-to-day diversion of milk directly from farms to plants located in different areas as the need exists, the marketing system for milk may be changed materially. The alterations may include changes in basic pricing points, in location price differentials, and in the accountability for milk.⁷

⁶Ibid., p. 1.

⁷The Dairy Situation, DS-260, Agricultural Marketing Service, USDA (June, 1957), pp. 21-22.

The Purpose of the Study

The purpose of this study is to investigate the changes in the volume of milk shipments from dairy farms which supply the Detroit market, as related to the adoption of bulk handling on these farms.

The Hypothesis

Milk shipments from farms which have adopted bulk handling of milk increase more rapidly in volume than shipments from farms which continue to ship milk in cans.

Locale of the Study

This study covers the milk marketing area regulated by Federal Milk Market Order Number 24, also known as the Detroit market. This includes the metropolitan area of Detroit and its suburbs; Ann Arbor; Pontiac; and Port Huron (Figure I-1).⁸ Milk marketed in this area is procured from the entire lower peninsula of Michigan, with the exceptions of the northwest and extreme southwest portions (Figure I-1).⁹

The procurement area for the Detroit market intermingles with the procurement areas of other city markets in the lower peninsula. A Federal hearing was held in Lansing during January,

⁸Stanton P. Parry, "Some Problems in Extending Federal Milk Order Regulations in Michigan", (unpublished Ph. D. thesis, Michigan State University, 1959), p. 4.

⁹Ibid., p. 47. Confirmed by letter from George Irvine, Administrator, Federal Order Market No. 24, Detroit, Michigan, March 5, 1959.

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The first part of the paper is devoted to the study of the properties of the function $f(x)$ defined by the equation

$$f(x) = \int_0^x \frac{1}{1+t^2} dt.$$

It is well known that this function is the arctangent function.

In the second part of the paper, we study the properties of the function $f(x)$ defined by the equation

$$f(x) = \int_0^x \frac{1}{1+t^2} dt + \int_0^x \frac{1}{1+t^4} dt.$$

It is well known that this function is the arctangent function.

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It is well known that this function is the arctangent function.

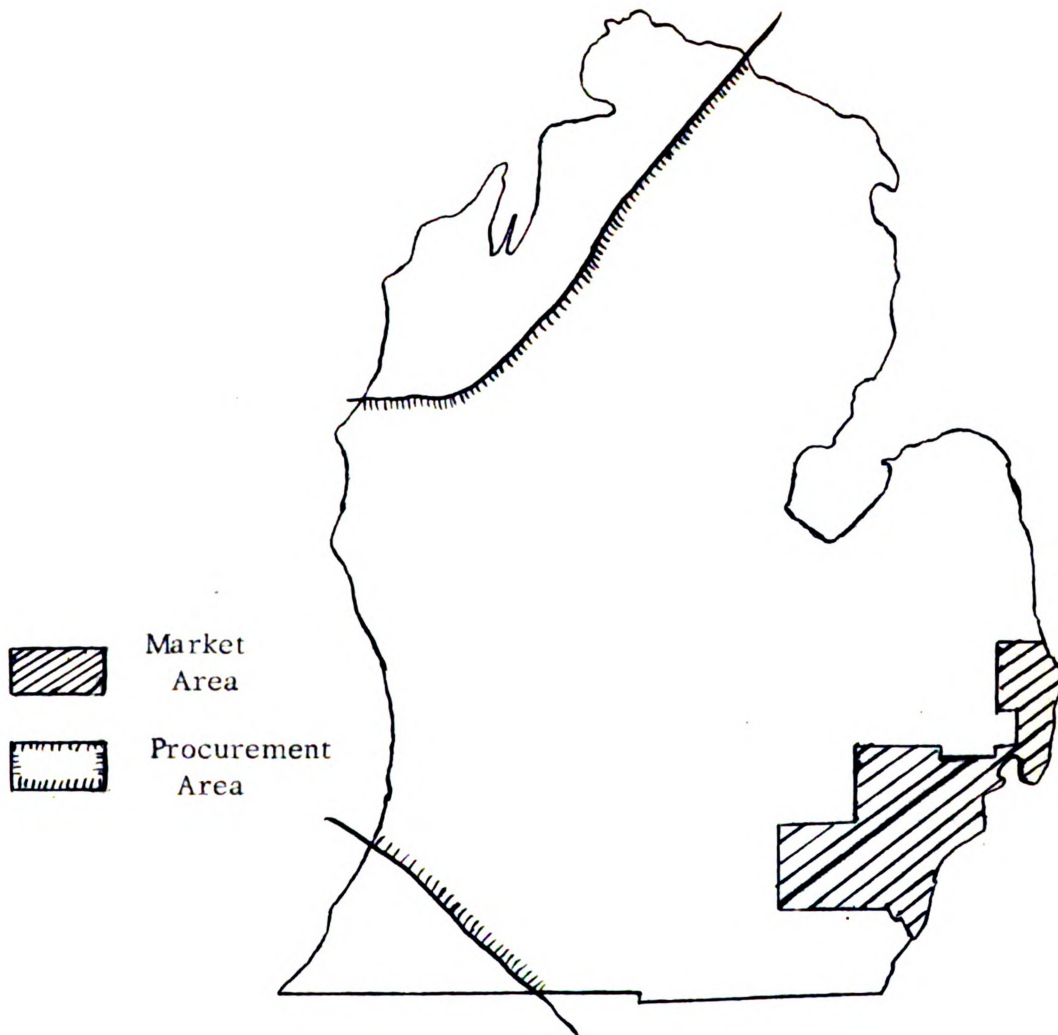


Figure I-1 Market and Procurement Areas, Federal Milk Market Order Number 24 (Detroit Market)*

*Source: Stanton Putney Parry, "Some Problems in Extending Federal Milk Order Regulation in Michigan", Unpublished Ph. D. Thesis, Michigan State University, 1958. Figure 1-1, page 4 and Figure 2-2, page 47.

1959, dealing with problems caused by the overlapping of procurement and sales areas. Two proposals asked that the remaining important markets not now under orders be brought under Federal regulation. One proposed that this be done by extending the present Detroit order, arguing that since the area was in effect one large market it should be treated as such. The other proposed that the area outside the present Detroit order be brought under a separate order. At this writing the decision of the Secretary of Agriculture has not been announced.

The Detroit area is atypical in that, unlike many other markets, conversion to bulk shipment has been largely voluntary. A few handlers gave notice that they would no longer receive milk in cans after a certain date, but in most cases those shippers who were unable or unwilling to convert were able to transfer to another station, another handler, or to stations operated by a producers' association.

Data necessary for the study were available for the Detroit area. Since it is the largest market in the state, a sufficient number of farms had adopted bulk handling by December, 1956, to give records for two full years of bulk shipment. Enough can shippers still remain in the area to furnish can shipment data for comparison of the two handling systems.

Method of Study

Necessary data were obtained from the records of the Michigan Milk Producers' Association. Annual shipment data were obtained for all shippers who had converted to bulk handling before

December 31, 1956. Shipment data were obtained for every twentieth can shipper. Data covered the Association fiscal years of 1955 through 1958. These methods produced usable shipment figures for 336 bulk shippers and 321 can shippers. Data obtained were analyzed on the bases of size of shipper, month of conversion, and change in shipments.

Organization of Thesis

This first chapter has served to introduce the topic of the study; to present the setting of the study; to set forth the purpose and hypothesis; to delineate the area covered by the study; and to give a quick review of method.

The second chapter will present a review of available literature relevant to this study. First, the history and development of bulk handling for the nation, state, and study area will be reviewed. Secondly, some comparisons in size between can and bulk shippers will be presented. Lastly, it will review the available studies which have preceded this study, concerning changes in shipments related to bulk handling.

The third chapter will deal with the analysis of data. Bulk shipments will be analyzed first, followed by can shipments. The analysis will then be concerned with both types, and the relationships between them.

The final chapter will deal first with conclusions suggested by the results of the analysis. It will then examine the implications of these conclusions. Finally, it will discuss opportunities for further research which have been suggested by this study.

CHAPTER II

REVIEW OF LITERATURE

This chapter will develop a background of knowledge concerning the development and adoption of bulk handling. Secondly, it will examine some comparisons in size between can and bulk shippers. Finally, it will review the results of the few studies available which have examined the changes in milk shipments as related to the adoption of bulk handling of milk.

History and Development of Bulk Handling

The adoption of bulk handling of milk has been one of the most rapid and far-reaching changes to affect the American dairy farm. This section will examine the background of bulk milk handling and the pattern of adoption in the country as a whole. After a review of its development in Michigan, the growth in numbers and its present status in the Detroit market will be examined.

The National Picture

History

The first bulk milk tank was reported in Illinois in 1923. Rock River Dairy, a producer-handler operation, found it inconvenient to handle milk in the normal way due to staggered milking hours. To cool and store the milk, the circulating hot water in a spray-vat pasteurizer was replaced with refrigerated

brine. Contrary to popular expectation, they experienced no difficulty with flocculent milk as a result of adding warm milk to cold. Remarkably low bacteria counts were achieved.¹

Bulk tanks first came into widespread commercial use in California during 1938. Large producers with several hundred cows found this to be a practical method of storing, and, in most cases, cooling milk. Large dairy farms in Florida eventually adopted the use of bulk tanks, but it was not until 1948 that bulk handling began to spread to other parts of the country. The first installations of the bulk system in the eastern section of the country, outside of Florida, were in Connecticut and South Carolina in 1948 and 1949.²

Since 1950 the number of bulk tanks on American farms has approximately doubled each year.

Present numbers

The Dairy Industries Supply Association, in cooperation with the National Association of Dairy Equipment Manufacturers, conducts an annual Farm Milk Tank Survey, covering each state. Data are furnished by various state Bureaus of Weights and Measures, state Departments of Agriculture, land grant colleges,

¹James B. Ball, "Was This the First Bulk Tank?", Hoard's Dairyman, Vol. CII, No. 22 (November 25, 1957), pp. 1142-1143.

²A. C. Woodruff, "Bulk Handling is for the Family Farm Too", ibid., Vol. XCVII, No. 6 (March 25, 1952), p. 278.

and some of the state dairy and dairy producer associations.³
Data for the United States are shown in Table I.

TABLE I
NUMBER OF FARM MILK TANKS, UNITED STATES, 1954-58*

Date	Number of Tanks	Percent Increase from Previous Study
August 1, 1954	13,358	---
January 1, 1956	29,885	127.0%
January 1, 1957	57,386	91.8
January 1, 1958	91,363	59.2

*Compiled from the following:

1. National Association of Dairy Equipment Manufacturers and Dairy Industries Supply Association, Survey Showing Number of Farm Milk Tank Installations by States as of January 1, 1956, MDD-4 (May 21, 1956).
2. NADEM-DISA, 1957 Farm Milk Tank Survey, MDD-6 (March 16, 1957).
3. NADEM-DISA, 1958 Farm Milk Tank Survey, MDD-10 (May 12, 1958).

Nearly half of the milk sent to 67 of the 68 Federal order markets during January, 1958, was cooled in farm bulk tanks. This is shown in a survey by the Dairy Division of the Agricultural Marketing Service which covered all but the New York-New Jersey order market. About one-third of the milk sent to Federal order markets is covered by this order.

During January, 1958, 47% of the total receipts of milk in these 67 markets came from farms using bulk equipment. These

³Dairy Industries Supply Association, "DISA Market Data Development", MDD-10, Market Data Development Subcommittee of the Dairy Industrial Market Data Service Committee (Washington, D.C., May 12, 1958).

farms represented 31.9% of all producers in the markets. One year previously, 33% of the milk which came to 64 of these markets came from farm bulk tanks. During January, 1956, 17.4% of the total milk deliveries in 53 markets came from farms having bulk cooling tanks.

In two markets covered by the survey, Southeastern Florida and Cedar Rapids-Iowa City, all of the market supply of milk came from bulk tanks. In seven other markets, more than 90% of the market supply came from bulk tanks. In 30 of the 67 markets reporting, more than half the total market supply of milk came from producers who had bulk tanks. In January, 1958, only four Federal markets showed no bulk shipments; these were Clarksburg (West Virginia), Fort Wayne (Indiana), Sioux City (Iowa), and Fort Smith (Arkansas).

A survey in January of 1956 showed no bulk tanks supplying the Omaha-Lincoln-Council Bluffs market, but in January of 1958, 83% of the market receipts were from farm tanks. During the same period the number of producers supplying that market dropped by 21%. In St. Louis and Eastern South Dakota markets, nearly two-thirds of the entire market supply shifted from cans to bulk in the two-year period.⁴

In the Louisville market a large part of the change to bulk came within one year. During January, 1956, 19.6% of the producers shipped milk from bulk tanks; these producers delivered 26.9% of the market supplies of milk. One year later 83.5% of producers, shipping bulk milk, accounted for 89.1% of the market

⁴Henderson, pp. 1-2, p. 6.

milk. In January, 1958, 90.3% of the producers shipped 93.6% of the milk in bulk; by December of 1958 these figures had edged up to 91.3% and 94.3%, respectively. During this three-year period the number of producers had dropped from 2,321 to 1,903.⁵

The sharp increase in the number of farm milk tanks appears to have taken place during the years 1955 through 1957. The growth rate decreases during 1958.

Michigan

The first tank in Michigan was installed for research studies at Michigan State University in October, 1951. The first commercial bulk pickup route was established in the Clare area early in 1952.⁶

The DISA-NADEM Farm Milk Tank Surveys indicate a phenomenal rate of growth in bulk tank numbers in Michigan, as follows: August 1, 1954, 250 tanks; January 1, 1956, 1,000 tanks; January 1, 1957, 3,000; and January 1, 1958, 8,000 tanks.⁷ Unofficial estimates, based on the number of tanks in each of the major markets in the state, place the number in January, 1959 at nearer 6,000.

⁵"Bulk Tank Development", The Courier, Vol. XIX, No. 9 (January, 1955), p. 4.

⁶D. L. Murray et. al., "Handling Milk in Bulk on the Farm", Extension Bulletin 342, Cooperative Extension Service, Michigan State University (May, 1957), p. 3.

⁷DISA-NADEM.

The AMS survey of January, 1958, showed that in January, 1957, the Muskegon market was one of seven markets out of the 67 Federal order markets which reported no bulk tank installations.⁸ In January, 1958, 49% of the total producer shipments were from bulk tanks used by 36.5% of the shippers. In January, 1959, 69.5% of the shippers had bulk tanks and delivered 77.8% of the milk in this market.⁹ Data for the Detroit and Muskegon markets represent about 43% of the milk production in the state.¹⁰

Detroit

Number of shippers

The first bulk tank installation was approved for Detroit shipments by the Detroit Department of Health in May, 1954. The cumulative number of installations approved each month thereafter is shown in Figure II-1. This table includes all approved installations; however, some left the market later. Department of Health figures showed 2,547 active bulk shippers in the market in December, 1958, and 8,006 can shippers.¹¹ United States Department of Agriculture figures show 2,772 producers with bulk tanks and 8,539 producers shipping in cans during January, 1959,

⁸Henderson, p. 4.

⁹U. S. Department of Agriculture, "Survey of Market Structure and Use of Bulk Milk Cooling Tanks on Farms, Muskegon, Michigan Market", Dairy Division, Agricultural Marketing Service, January, 1959.

¹⁰Letter from George Irvine, Market Administrator, Federal Milk Marketing Order No. 24, February 18, 1959.

¹¹Letter from Russell R. Palmer, Chief Milk Inspector, Department of Health, Detroit, February 25, 1959.

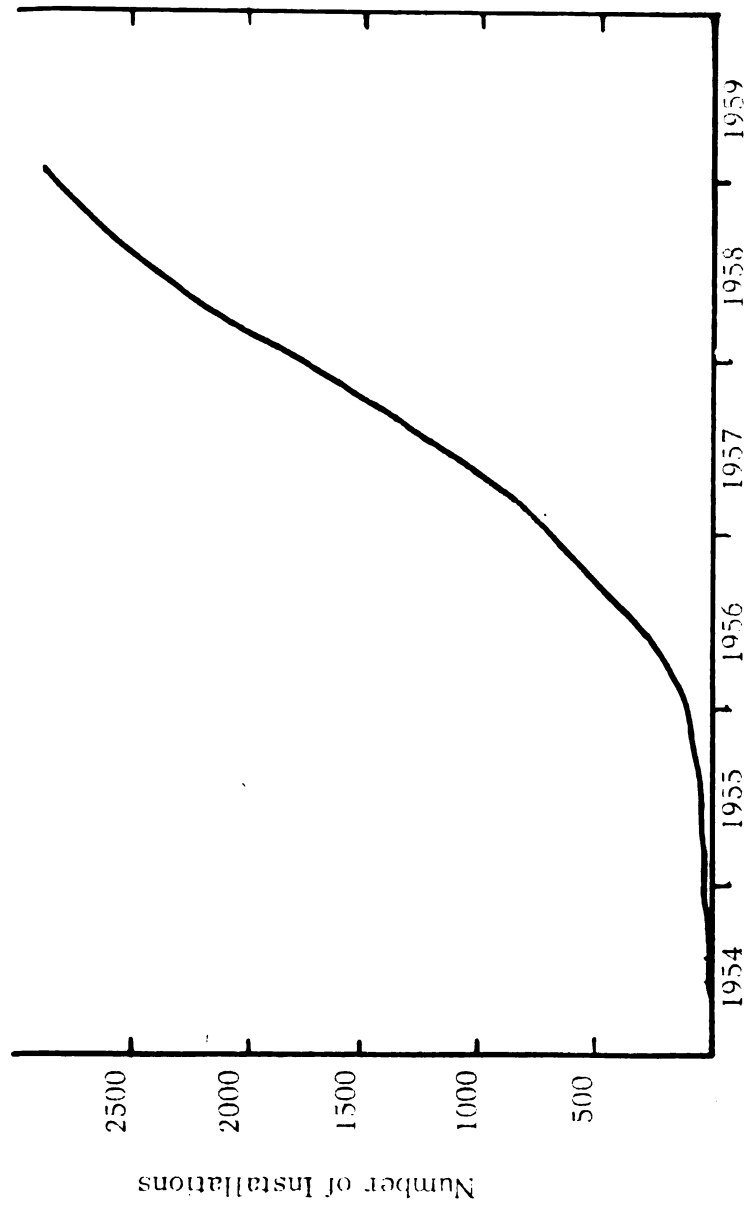


Figure II-1 Cumulative Number of Bulk Tank Installations Approved by the Detroit Health Department for Detroit Shipments, May 1954 thru January 1959*

*Source: Letter from Russell R. Palmer, Chief Milk Inspector, Department of Health, Detroit, February 25, 1959

compared with 2,014 and 10,082 one year previously. During the year total shippers decreased by 785, from 12,096 to 11,311.¹²

Receivers

Data from the Detroit Department of Health indicates that in January, 1959, 16 receivers still handled milk in cans only, from 807 shippers. Six plants received milk in bulk only, from 492 shippers, and 12 received both can and bulk from 10,020 shippers [sic]. With two exceptions, a supply plant receiving in bulk, and a distributing plant receiving in cans, all receivers with over 100 producers were receiving both can and bulk shipments. All can receivers were distributing plants. All supply plants received milk in bulk or in both bulk and cans.¹³

Comparative Shipment Volumes of Bulk and Can Shippers

It is widely assumed that bulk shippers produce a larger volume of milk than can shippers. Changes in volume of shipments over time, with which we are concerned in this study, may be as much related to volume of shipment from a given producer as to method of shipment. Therefore, we shall examine available information concerning relative volume of shipments from bulk and can shippers.

¹²U. S. Department of Agriculture, "Survey of Market Structure and Uses of Bulk Milk Cooling Tanks on Farms, Detroit Market", Dairy Division, Agricultural Marketing Service, January, 1959.

¹³A supply plant is one which receives milk for transfer to a distributing plant, rather than distributing milk itself. Distributing plants included here are those which received milk directly from producers.

Outside the Detroit Market

After bulk shipment has begun in an area, the amount and pattern of changes in costs encourage the larger volume group of the remaining can producers to be the next group to install bulk tanks. Thus, over time, the producers who are confronted with the question of bulk tanks are progressively smaller and smaller shippers.¹⁴

As the number of bulk milk shippers increases and the number of can shippers decreases, the average volume for bulk shippers might be expected to decrease because of the progressively decreasing size of the can shippers converting to bulk systems. In the Puget Sound (Washington) milk marketing area there was a steady decrease in the average volume among can shippers, from a seasonal range of about 400 to 600 pounds in 1951 to about 300 to 500 pounds of milk daily in 1955. Also, contrary to expectation, the average volume for bulk shippers remained substantially unchanged at about 600 to 800 pounds of milk daily. Apparently in each year it was mainly the larger can shippers who converted to bulk handling. This would explain the decrease in average daily milk shipment by can. However, it appears also that many of the producers who installed bulk handling systems then increased their milk production. This would help to explain the absence of a downward trend in average size of bulk shipments.¹⁵

¹⁴Donald B. Agnew, How Bulk Assembly Changes Milk Marketing Costs, Marketing Research Report No. 190, Marketing Research Division, Agricultural Marketing Service, USDA (July, 1957), p. 46.

¹⁵Ibid., pp. 47-48.

Agnew reported that in every region, Northeast, Midwest, South, and West, daily milk volume per producer averaged larger for the bulk shippers than for the can shippers delivering to the same firms in both 1953 and 1955. Although the number of bulk shippers increased from 1953 to 1955, there were fewer farms shipping milk in bulk than in cans in the latter year; but milk volume averaged much larger for bulk than for can shippers. Between 1953 and 1955, both the number of can shippers and their volume of daily shipment decreased in every region.¹⁶ However, on the same page with the above statement, Agnew reproduces a chart which shows the size of daily can shipments of two of the four regions remaining stable, one increasing, and one decreasing.¹⁷ Table 40, page 74, of Agnew's report is compiled from a survey obtained by the United States Farmer Cooperative Service, and agrees with the chart.¹⁸

In the Louisville Federal market in January, 1956, 19.6% of the producers had bulk tanks and shipped 26.9% of the total milk. By January, 1957, the figures were 83.5% and 89.1%, respectively. By December, 1958, 94.3% of the total milk was shipped in bulk by 91.3% of the producers. During the three-year period the number of producers in the market dropped from 2,321 to 1,903.¹⁹

¹⁶Ibid., p. 46.

¹⁷Ibid., chart from Neg. 3950-57 (3), Agricultural Marketing Service, USDA.

¹⁸Ibid., p. 74. Table compiled from Bulk Milk Handling in 1955, U. S. Farmer Cooperative Service General Report (April, 1956).

¹⁹The Courier, XIX No. 9 (January, 1955), p. 4.

A Farmer Cooperative Service (USDA) survey was taken in 1953 of all plants in the country known or believed to receive milk in bulk. Eighty-nine of these plants reported dual receiving operations. The daily delivery per shipper averaged 1,015 pounds for tank and 525 pounds for "graded" can, qualifying for the fluid market. Producers whose milk classified as "ungraded" or unqualified for fluid sales shipped an average of 210 pounds. Average daily farm delivery from all patrons was 438 pounds of milk. Tank shipments accounted for 20.8% of total volume and 9.0% of patrons; "graded" can, 59.3% of volume and 59.5% of patrons; and "ungraded" can, 19.9% of volume and 41.5% of patrons.²⁰

In the above survey, 84 plants reported herd sizes for their shippers in June, 1953. The range in average herd size of bulk milk shippers reported by firms was from 18 to 150 milk cows, and for can shippers from 10 to 60 cows. For all bulk shippers the mean size of herd for the 84 reporting plants was 40 cows; the median was 35 cows, and the mode was 30. For can shippers the mean was 22, and the median and mode were both 20 cows.²¹

In November, 1953, average daily milk deliveries for all 1,904 members of the Connecticut Milk Producers'

²⁰ Noel Stocker, Progress in Farm-to-Plant Bulk Milk Handling, Farmer Cooperative Service Circular No. 8, Farmer Cooperative Service, USDA (November, 1954), p. 13.

²¹ Ibid., p. 15.

Association, Hartford, were 508 pounds. The 214 member producers equipped at that time with farm tanks averaged 1,304 pounds per day.²²

In a study of milk volumes received from 10,288 producers by 53 Ohio firms in March, 1956, Dale Carley found that bulk producers were definitely larger shippers than can producers. Of the can producers, 68.5% shipped less than 400 pounds per day; 29.1% shipped 400 to 500 pounds; 2.3% shipped from 500 to 600 pounds; and the remaining 0.1% shipped from 600 to 700 pounds per day. In contrast, no bulk producer shipped less than 400 pounds; 10.7% shipped 400 to 500 pounds; and 45.1% shipped 500 to 600 pounds per day, including 5.2% who shipped over 900 pounds.²³ In total, 19.6% of the milk was received from the 11.8% of producers who had bulk tanks.²⁴ The average daily shipment per can producer in March, 1956 was 335 pounds; while the daily shipment of milk by bulk was 640 pounds per producer.²⁵

In 58 Federal order markets in January, 1957, the 16.2% of total producers who had bulk tanks handled 26.5% of the total milk deliveries. Producers with tanks averaged 765 pounds of milk per day, while average daily deliveries by all producers

²²Ibid., quoting Stewart Johnson, Dairy Marketing, Department of Agricultural Economics and Farm Management, College of Agriculture, University of Connecticut, Storrs (January, 1954).

²³Dale Herbert Carley, "An Analysis of the Impact of the Transportation of Milk by Bulk Methods from Farm to Plant in Ohio," (unpublished M.S. thesis), Ohio State University, 1956, p. 17.

²⁴Ibid., p. 12.

²⁵Ibid., p. 14.

were 464 pounds.²⁶ In the Minneapolis-St. Paul and Eastern South Dakota markets, however, the average producer delivered more milk than the bulk shipper.²⁷

In a January, 1958 survey of 67 of the 68 Federal Order markets, the assumption that bulk shippers were larger than can shippers was proved valid. In only one market, Upstate Michigan, did bulk shippers prove smaller than can shippers. The ratio of average daily deliveries of bulk shippers to average daily deliveries of can shippers in this case was .95. The largest difference was in the Nashville (Tennessee) market, where the ratio was 2.57. Bulk shippers averaged over twice as large as can shippers in 14 of the 67 markets.²⁸

The average daily delivery of milk per producer who used bulk cooling equipment in the 67 markets was nearly twice the average delivery per can shipper. The average daily delivery in bulk was 764 pounds compared to 412 pounds in cans. Larger producers and those who plan to expand their operations appear to adopt bulk cooling more readily than smaller producers.

However, the bulk cooling system is used by producers with relatively small as well as large operations. The size of bulk tanks used on farms gives an indication of the range in volume of output per farm. In 53 markets for which information relative to size of tanks was reported....less than two per cent of the total (had) a capacity of 100 gallons or less and....14% of the total (held) less than 200 gallons.²⁹

²⁶The Dairy Situation, p. 20.

²⁷Ibid., p. 21.

²⁸Henderson, pp. 7-9.

²⁹Ibid., pp. 1-2.

With every-other-day pickups prevailing in most areas, this would mean a maximum daily production for the farm of 50 gallons or 400 pounds.

The growth in use of bulk tanks has come during a period in which deliveries of milk per farm have risen rapidly. This survey did not attempt to determine the extent to which the increase in volume influenced or was influenced by the conversion to bulk tank equipment. It was observed, however, that in areas where average deliveries per farm were high the percentage of total market receipts delivered from bulk tanks tended to be high, and conversely where deliveries per farm were low the percentage of total market receipts from bulk tanks tended to be lower.

In 52 of the 67 markets the average delivery per producer using bulk cooling was 600 pounds or more per day whereas the average shipment in cans exceeded 600 pounds in only four markets. Average daily delivery per can shipper was under 400 pounds in 30 markets. In no market did the average daily delivery per producer using bulk equipment fall below 400 pounds. Expressed in other terms, in those markets where the average delivery of milk per producer was less than five ten-gallon cans (400 pounds) per day there were relatively more can shippers, whereas in markets where average deliveries exceeded the equivalent of seven cans (560 pounds) there were more producers with bulk equipment.³⁰

Detroit Market

In December, 1956, bulk producers averaged 646 pounds per day; in December 1957, the average was 690 pounds.³¹ Average daily shipment from bulk producers was 685 pounds in January, 1958, and reached 783 pounds in January, 1959, a 14% increase. During the same period average daily can shipments grew 8%, from

³⁰Ibid.

³¹Palmer.

368 to 398 pounds. In January, 1958, 27% of the total milk supplies came in bulk from 17% of the producers. One year later, 39% of the milk came in bulk from 24.5% of all producers. During this period total shipments increased 9.3%, but came from 6.5% fewer shippers.³²

Shipment Changes Related to Bulk Handling

Very little information is available concerning comparative changes in shipments by the two methods of handling.

An agricultural magazine stated that Ohio State reported that in two of their markets which have been using bulk tanks for two years production per producer was increased one-third over the last year in which the producer used cans.³³ However, correspondence with the authors and with the Department of Agricultural Economics at Ohio State failed to determine either the source or accuracy of this report.

Bulk milk shippers in two areas in Texas were interviewed during the spring and summer of 1957. Bulk equipment owners who at the time of the interview had been operating under the bulk system one year or longer had increased their milk production 24% at the end of twelve months, and the number of cows in their milking herds 19%. The increase in production by bulk producers was about three times greater than the increase of the average

³²USDA, "Survey of Market Structure....Detroit Market".

³³Paul L. Farris and Charles E. French, "Will You be Dairying in 1975?", Hoard's Dairyman, Vol. CII, No. 6, p. 317.

producer on the market and eight times greater than the increase of the average producer still delivering milk in cans.³⁴

Chicago Market

The question of changes in milk shipment volume following the adoption of bulk shipment in the Chicago procurement area has been studied by Hugh Moore.³⁵ This comprehensive study has been reported by the market administrator for the Chicago Federal order, along with a follow-up study covering the year immediately following the study.

The original study

Milk deliveries of over 400 producers in the Chicago procurement area were examined. These producers were originally all can shippers with comparable production records. Approximately half of these producers subsequently shifted to bulk tanks; therefore, shipment records of those who continued as can shippers could be compared with the records of those who converted to bulk shipment. Deliveries were examined for a two-year period; during the first year all producers were shipping by can and during the second year part were shipping by bulk. Of the 421 producers from twelve plants selected for the study, 203 were

³⁴Randall Stelly, Donald S. Moore, and Cecil A. Parket, "Bulk Handling of Milk on Texas Dairy Farms," Bulletin 894, Texas Agricultural Experiment Station, College Station, Texas, March, 1958.

³⁵Letter from Hugh Moore, Extension Specialist in Marketing, University of Wisconsin, Madison, Wisconsin, January 12, 1959.

1942年11月10日，在莫斯科，苏联政府向德国政府提出最后通牒，要求德国政府立即停止对苏联的侵略，并撤退其军队。

二、战争爆发

1941年6月22日，德国军队入侵苏联，标志着苏德战争的爆发。德国军队在巴巴罗萨行动中，以闪电战的方式，迅速突破了苏联的边境防线，深入苏联腹地。苏联军队在初期遭受了重大损失，但随后在斯大林格勒战役中，成功地抵挡住了德国军队的进攻，并最终在1943年1月反攻，将德国军队赶出了斯大林格勒。

三、战争进程

在战争初期，德国军队在苏联的领土上取得了巨大的胜利，占领了大片领土。然而，随着战争的深入，德国军队的补给线变得越来越长，其战斗力也逐渐下降。苏联军队在斯大林格勒战役中，成功地抵挡住了德国军队的进攻，并最终在1943年1月反攻，将德国军队赶出了斯大林格勒。此后，苏联军队在库尔斯克战役中，再次成功地抵挡住了德国军队的进攻，并最终在1944年反攻，将德国军队赶出了苏联领土。最终，在1945年5月，德国军队无条件投降，第二次世界大战结束。

四、战争影响

第二次世界大战对人类社会产生了深远的影响。战争期间，数以亿计的人失去了生命，无数城市被摧毁，人类社会遭受了巨大的灾难。战争结束后，世界格局发生了深刻的变化，美苏两国成为了世界上的超级大国，开始了冷战。

此外，战争还促进了科学技术的发展，许多新的发明和发现都是在战争期间诞生的。战争也改变了人们的生活方式，许多新的社会制度和价值观在战争期间形成，并对后世产生了深远的影响。

bulk producers. All bulk producers selected were on the market by June, 1954, and all converted to bulk between April 1 and August 1, 1955. For purposes of comparison, June, 1955 was considered to be their starting date for bulk. In order to compare the effects of the shift to bulk, 218 can producers of the same size were selected from the same plants.

To determine production changes, production records of the bulk producers for the year prior to going bulk were measured against the year after going bulk. Can producers' shipments were compared for the same periods. The results show the comparative increases over the same period for the two groups of shippers. The study assumes that, since all other factors were randomized, the adoption of a bulk tank was considered to be the primary factor in the producers' decision to increase production.

Producers were classified by size into four groups, based on production for the month of June, 1955.

In Group 1, consisting of producers with receipts for the month of 10,000 to 20,000 pounds of milk, bulk producers increased their production 15% during the first year following their conversion to bulk. Can producers in this group increased production 6.5% during the same time period.

In Group 2, with monthly production of 20,000 to 30,000 pounds, bulk producers increased production by 14.5%, while comparative can producers increased by 7.3%.

In Group 3, with June, 1955 production of 30,000 to 40,000 pounds, bulk producers shipped 9.3% more milk the first year while can shippers increased 4.2%.

In Group 4, producing 40,000 pounds and over for the month, bulk production went up 11.9% while can shipments increased only 0.7%. This last group was somewhat inconsistent with the other three. Up to 40,000 pounds there was some relationship between size of producer and increase in production. In general, the larger the producer, the smaller the percentage increase. The inconsistency of Group 4 may be partially due the small size of the sample included in this group.

Bulk producers as a whole showed a production increase of 13%. The average increase of all can producers was 5.7%. However, the sample contained proportionately less large-volume can producers than bulk producers. To make their size equal for comparative purposes, each can group was weighted by the number of bulk producers in its group. This gave a production increase of 5% for the adjusted can shippers, making an 8% increase in bulk production over can shipments.³⁶

The follow-up study

The above study covered a two-year period. During the first year all producers shipped milk in cans. Approximately half the producers shipped milk in bulk during the second year. This study was later continued to include another year of production, covering June, 1956, through May, 1957. The original 421 producers had been reduced to 359, with the loss of 35 can

³⁶"Bulk Tank Producers Boost Milk Production," The Reporter, Vol. XVII, No. 4 (December, 1956), pp. 1 and 5.

shippers and 27 bulk shippers. This reduction was due to such changes as producers leaving the market, shifting plants, or changes occurring in farm operators.

Production data for the first two-year period were re-examined to include only the remaining 359 producers. Of these, 176 had converted to bulk after the first year, while 183 remained on can delivery during the entire two-year period. The 176 bulk shippers showed an average increase in production during the second year of 15.8% over the first, while the 183 can shippers showed only a 5.5% increase. This compared with 13% and 5.7%, respectively, for the original group of 421 farms. This indicated a 10.3% greater increase for bulk than for can among the 359 producers, in comparison with 7.3% for the original group or 8% for the original group weighted in proportion to the number of shippers in each group.

Of the 176 bulk producers, 88% increased production, while 12% decreased. Of the 183 can producers 71% showed an increase, while 29% decreased.

The third year of the study reveals some interesting results. Of the 183 producers who shipped in cans the second year, 87 converted to bulk during the third year, leaving only 96 producers shipping in cans for the entire third year.

The 176 producers who changed to bulk after the first year showed an average increase of 4.8% in production during the third year, as compared to the second year. Of these producers, 68.2% increased production, while 31.8% experienced a decrease.

The 87 producers who converted to bulk during the third year showed an average increase of 7.2% in production during the third year over the second year. Of these producers, 78% showed an increase in production, while 30% experienced a decrease [sic]. This group had a 5% average increase in deliveries during the second year over the first year when their shipments were all by can.

The 96 producers who shipped in cans during the entire three-year period showed an average increase in production of 7.1% during the third year. Of these producers, 62% showed an increase in production, with 34% decreasing. This group had a 6.1% average increase in deliveries during the second year over the first year.³⁷

Percentage changes in shipments are shown in Figure II-2. It should be noted that conversion dates for those shippers converting during the third year are spread throughout the entire year; therefore, the increase in shipments does not cover an entire year of bulk shipments.

Conclusions of the studies

The report continues with the observation of some interesting aspects revealed by the data. Comparison of production during the second year with the first showed bulk producers increasing deliveries substantially more than can producers. However,

³⁷"Effect of Bulk Tank Assembly on Milk Production," The Reporter, Vol. XIX, No. 4 (April, 1958), pp. 1 and 4.

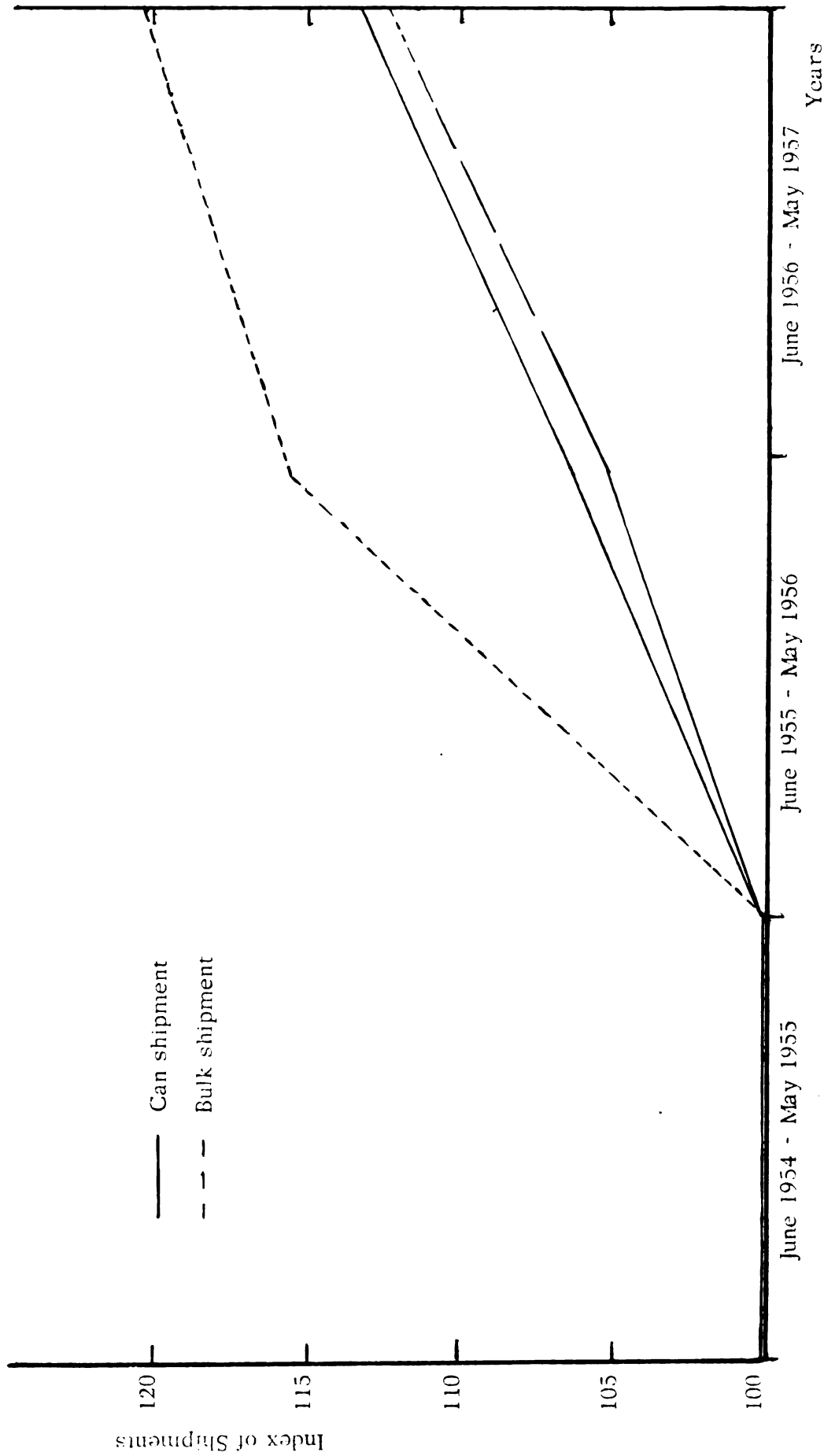


Figure II-2 Index of Changes in Milk Shipment Volumes by Type of Shipment, 1954 - 1957, Chicago Market*

*Source: "Effect of Bulk Tank Assembly on Milk Production", The Reporter, Vol. XIX No. 4 (April, 1958)
pp. 1 and 4

similar comparison of production during the third year with the second year showed the same bulk producers increasing deliveries, but to a much lesser extent than the increase experienced by the 96 can producers. The increase of the can producers was practically the same as the increase of the 87 producers who converted to bulk during the third year. In other words, the study thus far would indicate only that producers converting to bulk are likely to increase their production to a greater degree than can shippers during the first year of change. After that the rate of increase of the bulk producer slackens noticeably.

The report makes a related though somewhat different type of comparison. Of the 176 producers who shifted to bulk after the first year, 88% increased production while 12% decreased during the second year of production as compared to the first year. During the third year only 68.2% increased deliveries as compared to the second year, while 31.8% decreased deliveries. Those producers who continued to ship in cans for the entire period of the study showed less tendency to increase, with increases being 71% and 62% respectively, and decreases being 29% and 34%.

In its concluding analysis the report discusses the strong feeling in the milk industry that a marked increase in production is to be expected when a can producer shifts to bulk shipment. It is felt that ordinarily there is a tendency for a producer to install a bulk tank larger than necessary for his current production and then try to fill the tank. However, the size of the tank is a rigid factor, and when its capacity has been reached

production may be adversely affected. The can shipper, on the other hand, would have greater flexibility to meet increased production by merely using additional cans.³⁸

Summary

Moore's study of changes in shipment volume relating to the adoption of bulk handling in the Chicago market indicates that a significant relationship exists. An increase appears in shipments during the first year in bulk which is perceptibly greater than shipment increases from can producers during the same period. However, during the second year after conversion, the increase for bulk shippers is much less than that for can shippers during the same period.

Summary of the Chapter

Bulk handling came into commercial use in California during 1938, and in Florida later. In 1948 bulk handling began to spread across the country. Over half the milk received in Federal order markets outside New York comes from bulk tanks. The first commercial route in Michigan was established in 1952, while the first installation in the Detroit milkshed was approved by the Detroit Health Department in May, 1954.

In nearly all markets in the country bulk shippers have larger average shipments than can shippers. In the Detroit market during January 1959 39% of the milk came from the 24.5% of

³⁸ Ibid.

producers who had bulk tanks. During 1958 total milk shipments to the Detroit market increased 9.3%, but came from 6.5% fewer shippers.

In a study of the Chicago market, bulk shippers showed a 15.8% increase in production for their first year in bulk shipments, compared with the previous year. Can shippers showed only a 5.5% increase during the same period. However, bulk shipments increased only 4.8% during the second year.

CHAPTER III

THE DATA AND ANALYSIS

This chapter will deal with the source and procurement of the data, and the analysis of the data and its results.

Source and Procurement of the Data

Source of Data

Data for this study were procured from the records of the Michigan Milk Producers' Association. This association is the major cooperative marketing organization of dairy farmers in Michigan, covering major markets in the state. In December, 1958, about 84% of producers shipping to the Detroit market were members of the association. Since January, 1955, membership has varied to include from 81.5% to 86% of producers supplying the Detroit market.

Data included in this study, however, are not limited to the association members. Records are kept covering both member and non-member shippers. Since records for non-members were less complete over the period of the study, non-members are less than proportionately represented. Over the period of the study, average monthly shipments of non-members ranged from 84% to 104% of average member shipments. Non-member shipments averaged 96% of member shipments during the period.

Procurement of Data

The fiscal year upon which these records are based covers the period from October 1 to September 30. Annual shipment records for each producer within the restrictions detailed below were obtained for the fiscal years ending on September 30 of 1955, 1956, 1957, and 1958. In addition, daily base figures were obtained for the above producers who shipped to Association-owned stations. Base data were not available for producers shipping to non-Association stations.

Restrictions for bulk shippers

Data were obtained for each bulk shipper, subject to the following restrictions:

1. Date of conversion to bulk handling could be determined.
2. This conversion date was prior to January 1, 1957.
3. Complete annual data were available for the fiscal years of 1955, 1956, 1957, and 1958.
4. The producer continued to ship milk to the Detroit market at the time the data were obtained (January, 1959).

Adherence to these restrictions produced records for 336 shippers whose milk was being received by 17 stations of six dairy companies and the producers' association at the time the data were obtained. This group will hereafter be referred to as "bulk shippers".

Restrictions for can shippers

Restrictions were placed on can shippers as follows:

1. Complete annual data were available for the fiscal years of 1955, 1956, 1957, and 1958.
2. The producer was shipping milk to the Detroit market at the time the data were obtained (January, 1959).

Sampling method for can shippers

Since approximately 74% of present shippers in the area covered by this study continue to ship in cans, it was deemed inadvisable to obtain records for all can shippers. It was estimated that a 5% sample would yield approximately the same number of shipper records as the foregoing bulk sample. Every twentieth card was inspected in the file. If the shipper proved to be within the restrictions, necessary data were transferred to the worksheet; if not, the following card was used. In such a case, the nineteenth card following the card used was taken. In only a few cases was it necessary to go more than one or two cards past the twentieth. In these cases, one or more entire new loads had been added at the station during the period of the study. These were omitted from the count in determining the twentieth card.

The above method obtained the records of 321 can shippers from 27 stations of 12 dairy companies and the producers' association. This group will hereafter be referred to as "can shippers".

The Analysis and Results

The analysis first deals with bulk shippers, followed by the can shippers. The two groups are then compared.

Bulk Shippers

Analysis of the bulk shippers was first concerned with the distribution of the bulk shipper group by size class, and the changes in the distribution over the period of the study. This group was then analyzed by month of conversion. An investigation was made in terms of producers who increased or decreased shipment. Based on the foregoing analyses, a sample of bulk shippers was drawn, and subjected to more detailed analysis.

Distribution of the bulk shipper group

Frequency distributions by size class were made of the bulk shipper group for each of the four years. The cumulative distribution is expressed in percentages in Figure III-1.

In 1955, 64% of the bulk producers shipped less than 200,000 pounds of milk. During 1958, this group had dropped to only 36% of the total. The proportion of producers shipping over 300,000 pounds increased from 13% in 1955 to 31% in 1958.

Month of Conversion

The number of shippers converting to bulk each month increased over the period of the study. This is shown in Figure III-2. The following analysis involves those who converted during and after October, 1955.

1. The first part of the document is a letter from the President of the United States to the Congress.

2. The second part is a report from the Secretary of the Treasury on the state of the Union.

3. The third part is a report from the Secretary of the Navy on the state of the Navy.

4.

5. The fourth part is a report from the Secretary of the War on the state of the War.

6. The fifth part is a report from the Secretary of the Interior on the state of the Interior.

7. The sixth part is a report from the Secretary of the Agriculture on the state of the Agriculture.

8. The seventh part is a report from the Secretary of the Commerce on the state of the Commerce.

9. The eighth part is a report from the Secretary of the Education on the state of the Education.

10. The ninth part is a report from the Secretary of the Health on the state of the Health.

11. The tenth part is a report from the Secretary of the Labor on the state of the Labor.

12. The eleventh part is a report from the Secretary of the Finance on the state of the Finance.

13. The twelfth part is a report from the Secretary of the Justice on the state of the Justice.

14. The thirteenth part is a report from the Secretary of the State on the state of the State.

15. The fourteenth part is a report from the Secretary of the War on the state of the War.

16. The fifteenth part is a report from the Secretary of the Navy on the state of the Navy.

17. The sixteenth part is a report from the Secretary of the Interior on the state of the Interior.

18. The seventeenth part is a report from the Secretary of the Agriculture on the state of the Agriculture.

19. The eighteenth part is a report from the Secretary of the Commerce on the state of the Commerce.

20. The nineteenth part is a report from the Secretary of the Education on the state of the Education.

21. The twentieth part is a report from the Secretary of the Health on the state of the Health.

22. The twenty-first part is a report from the Secretary of the Labor on the state of the Labor.

23. The twenty-second part is a report from the Secretary of the Finance on the state of the Finance.

24. The twenty-third part is a report from the Secretary of the Justice on the state of the Justice.

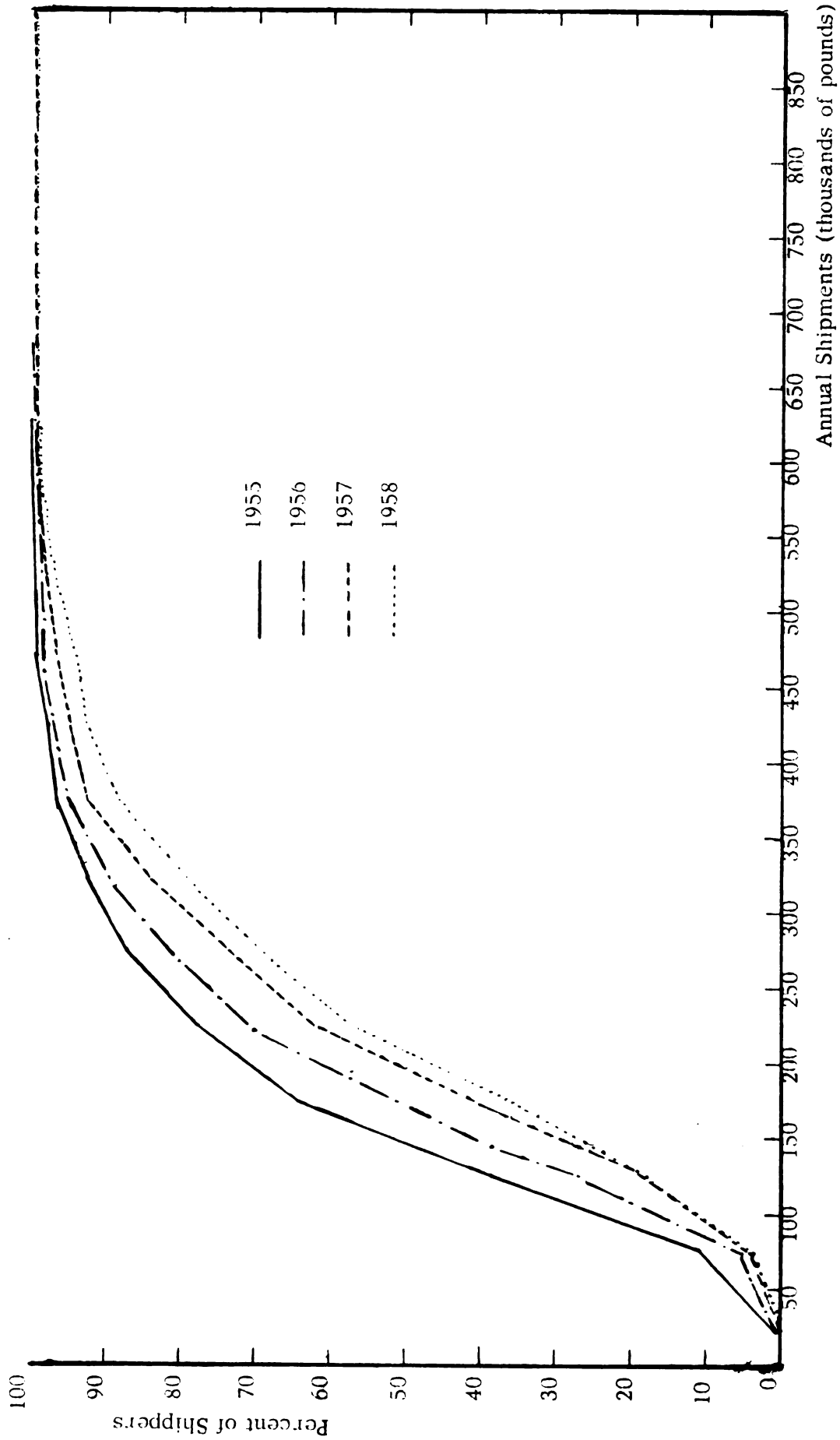


Figure III-1 Cumulative Percentage Distribution of Annual Shipments by Size Classes, Bulk Shipper Group, Detroit Market, 1955 - 58

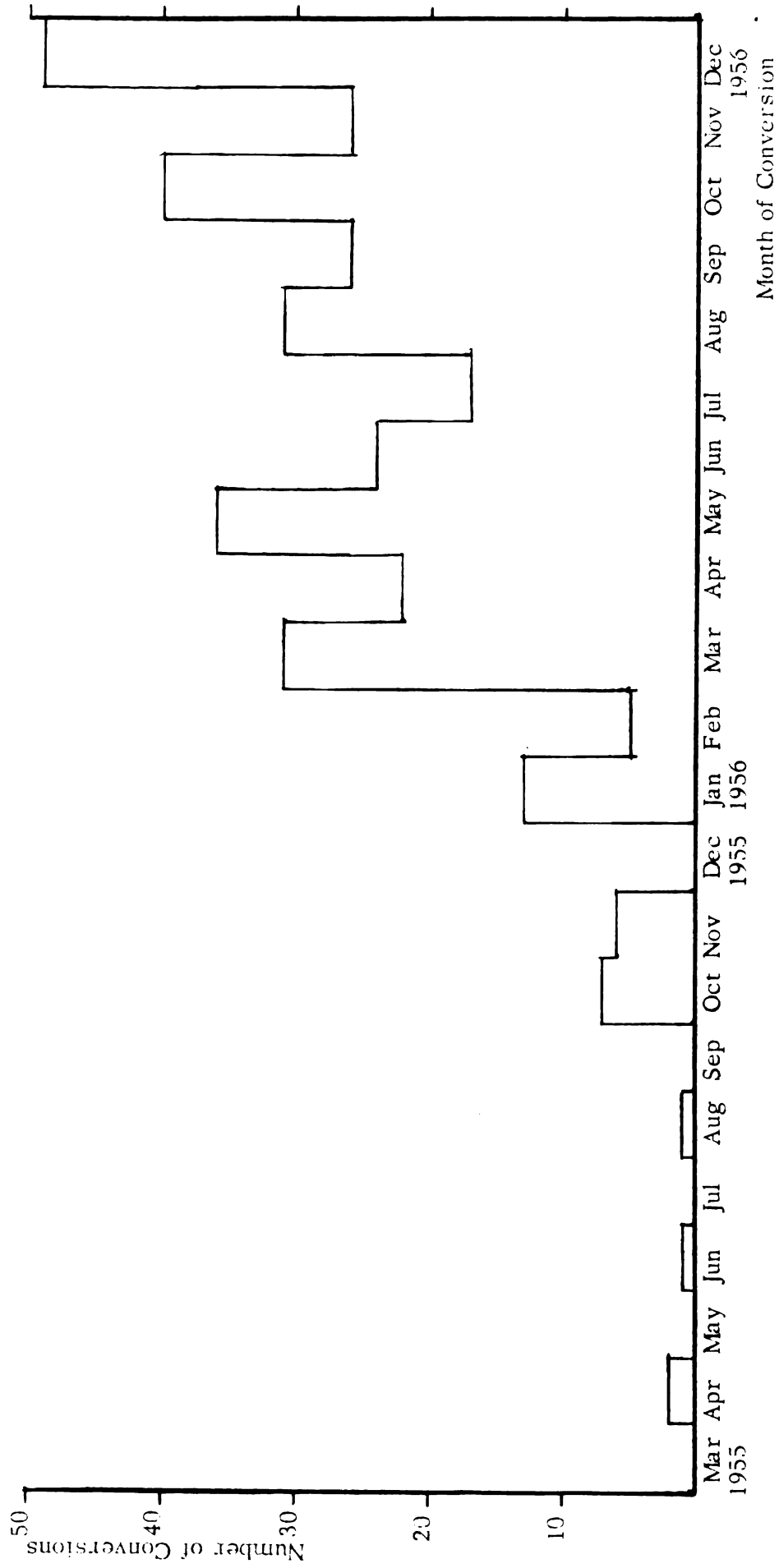


Figure III-2 Number of Shippers in Study of Detroit Market who Converted to Bulk Shipment, by Months

Dispersion from the mean

Standard deviations of annual shipments for each of the four years were computed for each month of conversion. Due to the wide dispersion of annual shipments these standard deviations were quite large. To change the range of standard deviations from absolute to proportional figures, the standard deviations were divided by their corresponding mean, annual shipments, giving relative standard deviations, or coefficients of variation. This showed dispersions from these means to be quite high. For 1955 shipments, coefficients of variation ranged from a low of 29.6% for those converting in November, 1955 to a high of 54.9% for those converting in November, 1956. The highest coefficient of variation was 60.9%, for the 1958 shipments of those converting in May, 1956. Standard deviation increased over the four-year period for every monthly conversion group but February, 1956, which had only five observations. However, this is inconclusive, since the means were also increasing in every case. Of the 14 monthly conversion groups, nine showed an increased coefficient of variation over the four-year period, while four decreased and one remained substantially unchanged. This indicates that the dispersion increased relative to the mean. While minimum producer shipment volume remained about the same, maximum shipments increased to an extent relatively greater than the increase in mean shipments.

Proportion of producers increasing or decreasing shipments

Classification

All of the 336 bulk shippers were classified into four groups as follows:

1. The increase group, whose annual shipment volumes increased during any of the fiscal years 1956 through 1958 to a point over 10% above their shipments for the base period, which was the fiscal year 1955, and at no time fell to more than 10% below the base period.
2. The decrease group, whose annual shipment volumes during the study period did not increase 10% over the base period, but which fell to 10% or more below the base period.
3. The stable group, whose shipments at no time varied more than 10% from the base period.
4. The erratic group, whose shipments increased above and also dropped below the 10% limit of change from the base period.

Moore's study of the Chicago market used only two classifications; those who increased production and those who decreased.¹ It was felt that the four classifications used in this study would allow for normal fluctuations in farm operations, but identify significant changes. In addition, the fourth classification identifies shippers with erratic patterns of output.

Changes

Of the 336 bulk shippers, 274 or 81.6% were in the increase group. However, 17 or 5% of the total fell back below the 10% limit during 1958. Of the 274 shippers who increased production,

¹The Reporter, XIX, No. 4, p. 4.

24 doubled shipments during the period of the study, while three of these 24 tripled shipments. The producer with the greatest increase in shipments had a 1958 volume which was 303% of his shipment volume in 1955.

Twenty-six bulk shippers, or 7.7% of the total, were in the decrease group. Four of these 26, had shipment figures which had decreased to less than 50% of shipments during the base year, with a low of 35%.

Only 21 or 6.2% of all bulk shippers remained stable during the four-year period. Fifteen or 4.5%, had erratic patterns of shipment.

Means of the change groups

The mean of bulk shippers who increased production was 190,742 pounds of milk shipped during 1955. The 1955 mean of the decreasing group was 206,709 pounds. The mean for the stable group was 207,732 pounds. The 4.5% of shippers who showed an erratic pattern of shipment showed a mean of 214,393 pounds; this is considerably above the means of the other three groups, and over 10% above the mean of the entire bulk shipper group.

Selection of the bulk sample

In order to make the study more reliable, as explained below, it was necessary to select a portion of the total bulk group; this portion will hereafter be known as the "bulk sample".

Month of conversion

In order that data for a year of can shipments or a year of bulk shipments be valid, the year's record must fall quite

completely into one of the two categories, rather than having one annual datum consist of six months of each. The sample taken must also be large enough to give validity. Shipment data were available by fiscal years only.

The end of the fiscal year of 1956 was taken as a centering date, and records used were those of shippers converting during the month preceding and the month following this date. This gave records for two months, September and October of 1956, for 66 shippers. This was also done for two months previous to and two months following the centering date, or August through November; and three months before and after, or July through December.

Erratic shippers

It was noted that 15 or 4.5% of all bulk producers were erratic in shipment patterns, with production during the period of the study going both above and below 10% increases and decreases from the base year shipment. Such a pattern is considered to be due to the impact of abnormal forces. These patterns would not be planned or expected in normal farm operations; therefore, the records of these shippers were eliminated from the sample.

Evaluation of alternative samples

Means - The 1955 mean of the bulk shipper group was 194,119 pounds. The means of the two, four, and six-month samples were 173,217, 192,422, and 189,942, respectively.

Cumulative percentages - The cumulative percentages of annual shipments by size classes for the bulk shipper group and the two, four, and six-month samples, based on 1955 data, were computed. The cumulative percentages of the four and six-month groups lie every close to the mean of the bulk shipper group; the two-month group is not as close.

Number in samples - The two-month group contains 66 shippers; the four-month group, 118; and the six-month group, 180.

Choice of a sample group

The mean of the four-month group lies closest to the bulk shipper group. The six-month group appears to have little, if any, advantage in accuracy over the four-month group, in terms of cumulative percentage. The smaller sample will simplify computations. Therefore, the four-month group, covering shippers who converted to bulk shipment during the period of August through November, 1956, is chosen as the bulk sample for further analysis.

Analysis of the bulk sample

The sample of 118 bulk shippers who converted to bulk handling during August through November, 1956, was analyzed on the basis of annual shipment for the fiscal years of 1955 through 1958.

Means of the bulk sample

The mean of the bulk sample for the 1955 fiscal year was 192,422 pounds of milk. The 1956 mean was 210,180 pounds, a 9.2% increase. For 1957, the mean increased to 240,918 pounds, a 14.6%

increase over 1956 and 25.2% over 1955. The 1958 mean was 258,737, a 7.3% increase over 1957. Mean annual shipments for the bulk sample increased 34.4% over the period of the study.

Changes within size groups

Table 2 illustrates relative changes for various size groups. Classifications were based on shipment volumes during 1955. Only classes containing eight or more observations were used, comprising 91.4% of the sample, although the entire sample entered into the total. It appears that smaller producers show a greater proportional increase in shipments than large producers.

TABLE 2

ANNUAL AND TOTAL PERCENTAGE
INCREASES BY SIZE GROUPS, BULK SAMPLE, 1955-58

Size Group	50- 100	100- 150	150- 200	200- 250	250- 300	300- 350	Bulk Sample	
N=	15	33	29	12	11	8	Percent increase	Percent cumulative increase
Percent Increase								
55-56	33.0	15.0	13.0	7.0	2.4	2.6	9.2	9.2
56-57	28.0	19.0	22.0	10.0	5.4	6.0	14.6	25.2
57-58	0.9	7.0	11.0	2.2	5.4	10.0	7.3	34.4
55-58	71.0	47.0	53.0	19.0	14.0	20.0	----	34.4

Can Shippers

The distribution by classes of the can shipper group over the period of the study was determined. Shippers increasing production and those decreasing were studied. A sample of can shippers was set up for more detailed analysis.

Comparison of Can and Bulk Shippers

Pertinent points in the foregoing analyses will be combined to show relationships between can and bulk shippers.

Distribution of the can and bulk shipper groups

Cumulative percentage distributions for 1955 and 1958 can and bulk milk shipment means, in Figure III-4, illustrate comparative volumes of milk shipments and comparative changes.

Thirty-six percent of 1955 can shippers and 30% of 1958 can shippers lie below the 100,000 pound level, while the figures for bulk shippers are 10 and 4%, respectively. Variation is much greater at the 200,000 pound level, with 88% of the 1955 can shippers and 81% of 1958 can shippers below this level, while for bulk the figures are 64% and 36%. At the 300,000 pound level, 97% and 95% of can shippers are below, while the figures for bulk are 87% and 69%; in 1958 only 5% of all can producers shipped over 300,000 pounds, while 31% of the bulk producers shipped more than this amount.

Proportion of shippers increasing or decreasing production

Changes

Fifty-eight percent of the can shippers and 81.6% of the bulk shippers increased volume 10% or more during the four-year period. Twenty-six percent of can shippers and 7.7% of bulk shippers decreased shipments 10% or more. Eight percent of the can shippers and 6.2% of the bulk shippers varied shipments less than 10% during the period. Another 8% of can shippers

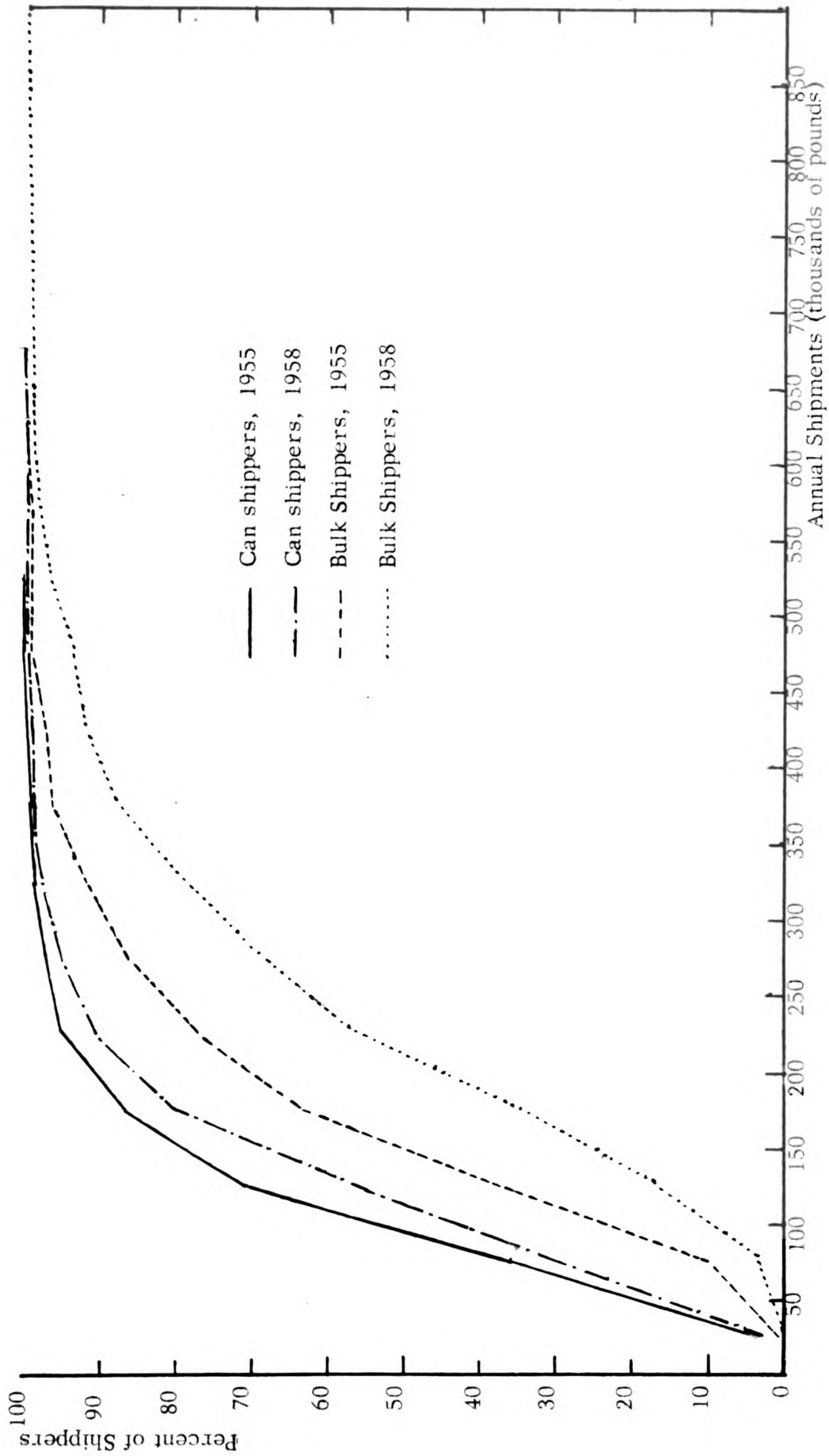


Figure III-4 Cumulative Percentage Distribution by Size Classes of 1955 and 1958 Shipments, Can and Bulk Shipper Groups, Detroit Market

Eighty-two can shippers, or 26% of the total were in the decrease group. Four of these had cut shipments to less than half of the 1955 volume, with a low of 20%. Twenty-six shippers, or 8%, had a stable volume of shipments. The remaining 26 showed erratic patterns of shipment.

Means of change groups

The mean 1955 shipment of can producers who increased shipments was 127,787 pounds, compared with 130,866 for the entire can shipper group. The 1955 mean of the decreasing group was 141,185 pounds. The 1955 mean of the stable group was 146,375 pounds, the highest of the four groups. The shippers who showed an erratic pattern of output had a mean of 104,963 pounds, far below the other three groups.

Selection of the can sample

The 321 can shippers dealt with in this study were systematically drawn from many times this number of available records. In this sense the sample has been previously selected. However, 26 or 8% of these 321 shippers showed erratic shipment patterns, with production during the period of the study going both above and below 10% increases and decreases from the base year. As was noted in the selection of the bulk sample, such changes were considered to be due to the impact of unusual forces; therefore, the records of these shippers were eliminated from the sample.

Analysis of the can sample

The sample of 295 can shippers will be analyzed on the basis of annual shipments for the fiscal years of 1955 through 1958.

Means of the can sample

The mean of the can sample for the 1955 fiscal year was 133,150 pounds of milk. The 1956 mean was 142,300 pounds, a 6.8% increase. For 1957 the mean increased to 147,336 pounds, a 3.5% increase over 1956 and 10.6% over 1955. The 1958 mean was 150,318, a 2% increase over 1957. Mean annual shipments for the can sample increased 12.8% over the period of the study.

Changes within size groups

Table 3 gives relative changes for various size groups. Classifications are based on shipment volumes during 1955. Only classes with 12 or more observations are used, comprising 95% of the shippers in the sample. The entire sample enters into the total. It appears that smaller producers show a greater increase in proportion to their size than larger producers.

TABLE 3
ANNUAL AND TOTAL PERCENTAGE
CHANGES BY SIZE GROUPS, CAN SAMPLE, 1955-58

Size Group	0- 50	50- 100	100- 150	150- 200	200- 250	Can Sample	
N	12	92	104	47	25	Percent Increase	Percent cumulative increase
Year	Per Cent Change						
55-56	+41.5	+8.5	+8.2	+6.4	+3.1	6.8	6.8
56-57	+ 6.0	+5.1	+4.4	+4.4	-0.1	3.5	10.6
57-58	+15.2	+4.1	+6.1	+1.1	-0.6	2.0	12.8
55-58	+73.0	+18.8	+20.0	+12.4	+2.5		12.8

1. The first part of the document discusses the importance of maintaining accurate records of all transactions.

2. It also emphasizes the need for regular audits to ensure the integrity of the financial data.

3. Furthermore, the document highlights the role of transparency in building trust with stakeholders.

4. The following table provides a detailed breakdown of the financial performance over the last quarter.

Category	Q1 2023	Q2 2023	Q3 2023	Q4 2023
Revenue	120,000	135,000	140,000	150,000
Expenses	80,000	85,000	90,000	95,000
Profit	40,000	50,000	50,000	55,000
Growth (%)	5.2%	6.8%	7.1%	8.5%

5. The data indicates a steady increase in revenue and profit, reflecting the company's growth strategy.

6. It is recommended that the company continue to invest in research and development to maintain its competitive edge.

7. The following section outlines the key challenges and opportunities for the upcoming year.

- **Challenges:** Increased competition, rising costs of raw materials, and potential regulatory changes.
- **Opportunities:** Expansion into new markets, diversification of product lines, and strategic partnerships.

8. The document concludes with a call to action for all stakeholders to work together towards a successful future.

The mean shipment of the bulk sample increased in 1956 to a level 9.2% over the 1955 mean. During 1957 the increase was 14.6% over the previous year, while in 1958 mean bulk shipments for the sample increased 7.3% over 1957. For the same periods, the yearly increases of the can sample means were 6.8%, 3.5%, and 2.0%, respectively. For the period of the study, the mean of the bulk sample increased by 34.4% over the 1955 base period, while the mean of the can sample increased by 12.8%. These changes are illustrated in Figure III-8. The greatest increase for the mean of can shippers, which took place in 1956, was less than the smallest change for bulk. The greatest increase in mean shipments for the bulk sample was in 1957, the first year following the adoption of bulk handling. The change in 1958, the second year of bulk handling, was smaller than in 1956, the year before conversion to bulk handling.

A least squares regression line was computed for the annual means of each of the two groups. Application of the *t* test showed the slope of the regression line for bulk shippers to be significantly greater at the 1% level than the slope of the regression line for can shippers (Appendix I). This means that bulk shippers showed a significantly greater increase in shipments over the period of the study, in proportion to their size, than can shippers.

Changes within size groups

In both can and bulk shipments, small shippers demonstrated a greater proportional increase than larger shippers. It is especially significant, however, that bulk shippers

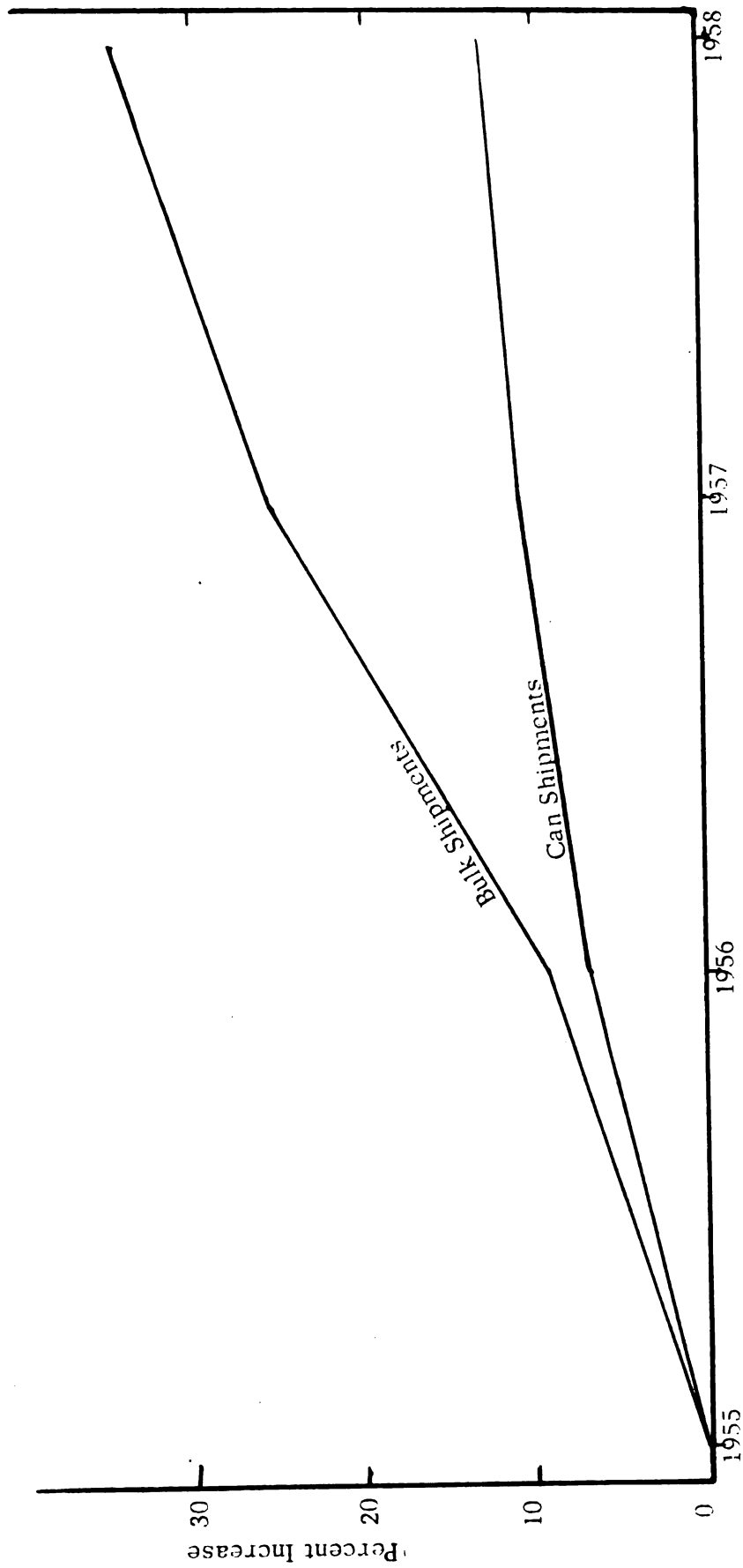


Figure III-8 Percent Annual Increases, 1955 - 58, in Mean Producer Milk Shipments, Can and Bulk Sample Shipper Groups, Detroit Market (1955 = 0)

increased faster than can shippers, although they were larger. Bulk shippers showed an increase of 34.4% in mean shipment volume over the period of the study, compared with a 12.8% increase for can shippers.

Summary of the Chapter

Data were obtained from the records of Michigan Milk Producers' Association for 336 shippers who had converted to bulk handling prior to January 1, 1957, and 321 shippers who were still shipping in cans at the time of the study. The majority of the former group converted during the latter part of 1956. Two-thirds of the can shippers and four-fifths of the bulk shippers increased shipments more than 10% during the period of the study. The 4.5% of bulk shippers and 8% of can shippers whose volume varied more than 10% in both directions from the base year were eliminated from the sample. Bulk shippers converting during the two months preceding and two months following the end of the fiscal year were chosen for the bulk sample.

Annual mean shipments for the bulk sample were in every case greater than any annual mean for the can sample, as were percentage changes in these means. The greatest annual increase in bulk shipments was 14.6%. This occurred in 1957, the first year of bulk shipments. The increase in mean volume of milk shipped by the bulk sample over the period of the study was significantly greater than the increase for the can sample. Small shippers in each shipment group showed a greater increase

in proportion to size than larger shippers. However, bulk shippers showed a greater percentage increase in volume of milk shipped than can shippers, despite the fact that they were larger.

CHAPTER IV

CONCLUSIONS, IMPLICATIONS, AND OPPORTUNITIES FOR FURTHER STUDY

This chapter will first deal with some conclusions concerning the study. Following this, the implications of the study results will be explored as they relate to producers, haulers, and the market as a whole. Finally, since a study such as this brings forth more questions than it answers, opportunities for further studies in this area will be discussed.

Conclusions of the Study

The first portion of this chapter explores relevant points of the analysis carried out in the previous chapter, and discusses conclusions drawn from the data. It deals with the size distribution of shippers, number of shippers making significant changes in volume, and changes in the means of milk shipments during the study and changes within size groups.

Size Distribution of Shippers

Figure IV-1 shows frequency distributions by size classes for both can and bulk shipper groups, for the base year of 1955 and the final year of 1958. It must be remembered that virtually all milk shipped by the bulk producers during 1955 was still handled in cans.

During 1955, over half the bulk shippers in the study had shipment volumes of 100,000 to 200,000 pounds of milk,

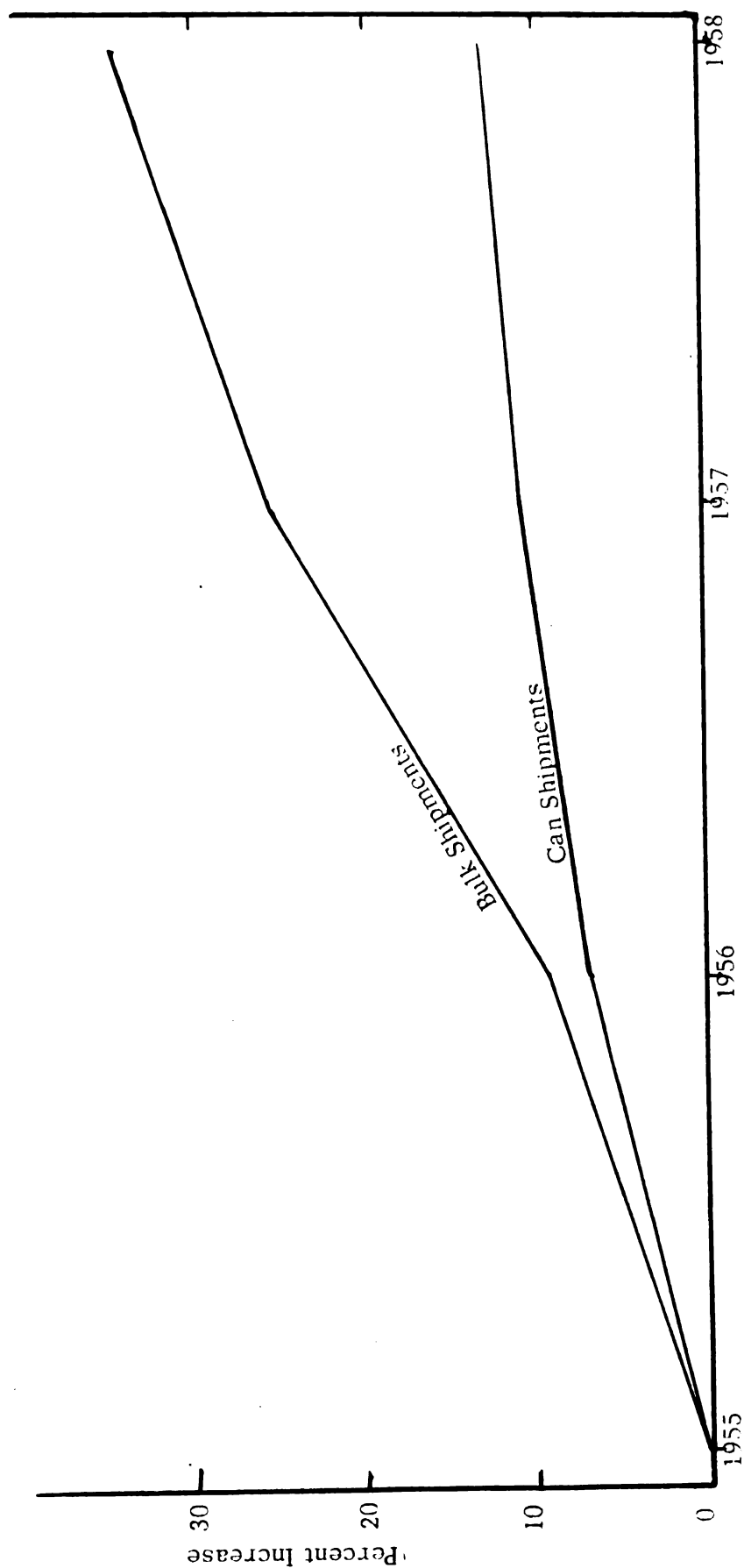


Figure III-8 Percent Annual Increases, 1955 - 58, in Mean Producer Milk Shipments, Can and Bulk Sample Shipper Groups, Detroit Market (1955 = 0)

increased faster than can shippers, although they were larger. Bulk shippers showed an increase of 34.4% in mean shipment volume over the period of the study, compared with a 12.8% increase for can shippers.

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Data were obtained from the records of Michigan Milk Producers' Association for 336 shippers who had converted to bulk handling prior to January 1, 1957, and 321 shippers who were still shipping in cans at the time of the study. The majority of the former group converted during the latter part of 1956. Two-thirds of the can shippers and four-fifths of the bulk shippers increased shipments more than 10% during the period of the study. The 4.5% of bulk shippers and 8% of can shippers whose volume varied more than 10% in both directions from the base year were eliminated from the sample. Bulk shippers converting during the two months preceding and two months following the end of the fiscal year were chosen for the bulk sample.

Annual mean shipments for the bulk sample were in every case greater than any annual mean for the can sample, as were percentage changes in these means. The greatest annual increase in bulk shipments was 14.6%. This occurred in 1957, the first year of bulk shipments. The increase in mean volume of milk shipped by the bulk sample over the period of the study was significantly greater than the increase for the can sample. Small shippers in each shipment group showed a greater increase

while two-thirds of the can shippers fell between 50,000 and 150,000 pounds. There were comparatively few smaller shippers, and the distribution frequency drops off sharply after these points. The modal class in each case was 100,000 to 150,000 pounds.

By 1958, both can and bulk distributions showed a marked change toward larger size groups. The change was more pronounced in the bulk shippers. The distributions were less dominated by any particular size groups.

The 1955 figures lead to conclusions that relatively few producers whose 1955 shipments were below the 100,000 pound level had converted to bulk by December 31, 1956, and that proportionately few shippers over 150,000 pounds continued to ship in cans.

The size ranges in 1955 may indicate a common and practical level of output which was accepted as a standard for the family dairy farm in the area. Changes in technology and economic conditions appear to have modified this common and practical level. While the dairy industry is constantly in a state of transition, as is any live and dynamic organization or organism, this rate of transition was accelerated during the period of the study.

Shippers Making Significant Changes in Volume

Three-fifths of the can shippers and four-fifths of the bulk shippers in the study increased shipments during the period of the study to 10% or more above their shipments during the base

year of 1955. The means of these increase groups were in both cases smaller than the means of their entire shipper groups. This is consistent with the finding that the smaller size classes show a much larger percentage increase in volume during the period of the study than the larger classes.

Twenty-six percent of can shippers and 7.7% of bulk shippers decreased 10% or more. Eight percent of the can shippers and 6.2% of the bulk shippers varied shipments less than 10% from the base year. The means of both these groups were well above the means of their shipper groups. This does not necessarily indicate that larger shippers tend to remain stable or decrease. Since smaller shippers have a tendency to increase greatly, the remaining larger shippers find themselves above the mean for the entire group. . .

One can shipper in 12 and one bulk shipper in 22 showed erratic patterns of shipment during the study. Their shipments dropped below 90% of base year shipments and also increased to over 110% of base shipments during the three years following the base year. The mean for the erratic group of can shippers fell considerably below the mean of the entire can group, while the mean for the erratic group of bulk shippers was greater than for any other change group.

Such erratic patterns of shipment seem abnormal. They may be the result of factors affecting the farm business which are partially or largely uncontrollable. Changes in tenants may have considerable effect on a farm business. Association membership contract changes indicated that several of these farms

were transferred within the family. Serious disease problems may result when cattle are bought to enlarge the herd. Some erratic changes may reflect poor planning and management. The widely differing means of the erratic shippers in the can and bulk groups relative to the means of their entire shipper groups indicate that the factors affecting the two erratic groups may be different.

The trend in the dairy industry is toward fewer and larger shippers. This was borne out by the very large number of shippers who increased production. The bulk tank has commonly been associated with increasing volume. This is shown to be the case in the study, with the bulk "increase" group being considerably larger in numbers than the can "increase" group, and all other bulk change groups being smaller than corresponding can groups.

Changes in Milk Shipments Over Time

Annual means of the bulk sample were from 145% to 172% of the can sample means, with the difference increasing each year. Bulk shippers had larger volumes than can shippers, and were showing a larger percentage increase each year.

Changes in means

Percentage increase in mean shipments over the previous year for can shippers was greatest during 1956. Bulk shippers showed a slightly greater increase than can shippers during this year. The bulk shipper sample upon which these statements are based converted to bulk shipment within two months before and two months after the end of the 1956 fiscal year. Monthly

shipment records indicate that in many cases shippers make significant increases in shipments before the conversion takes place, as if anticipating the conversion and preparing for it.

Bulk shipments increased sharply during 1957, the first full year of bulk handling. This is in marked contrast to can shippers, who increased less than in the previous year. The difference would appear to be directly related to the adoption of bulk handling.

Percentage increase for bulk shippers in 1958 was nearly the same as in 1956, while can shippers increased even less than before. The contrast is quite evident when cumulative increases are compared. The cumulative bulk shipment increase over the four-year period was 35%, contrasted with 13% for can shipment.

Changes within size groups

The greatest percentage increases in shipments over the four-year period came in the smallest size classes of each shipment group. The 0 to 50,000 pound can class, with 12 observations, showed a 73% increase. The 50,000 to 100,000 pound bulk class, with 15 observations, increased by 71%, while the 50,000 to 100,000 pound can class increased 19%. With minor exceptions, percentage increases tended to become smaller with larger size classes.

Changes in dairying during the years of the study have tended to force dairymen to expand or expire. Unfortunately, this study could not deal with the characteristics of those dairymen who chose the latter. The above figures would indicate

that, in general, shippers with a volume of under 50,000 pounds who chose to remain in dairying greatly increased shipments but continued to use cans, while those who were above 50,000 pounds and who expanded greatly converted to bulk. It is interesting to note that the largest expansion for all size classes of can shippers was in 1956, while for bulk shippers these classes made the greatest expansion during 1957, the first year of bulk shipment.

Summary

Both can and bulk shippers showed an increase in shipment volumes. A larger proportion of bulk shippers increased shipments than was true for can shippers. The basic hypothesis of this study was borne out; bulk shippers showed a much greater percentage increase in shipments all during the study. This was despite the fact that while bulk shippers were larger, the percentage increase in shipments tended to be less for larger shippers.

Implications of the Conclusions

This section explores the conclusions reached from the analysis, and the implications which they have for the producer, hauler, and for the market as a whole.

Implications for the Producer

The basic conclusion of the study proves the hypothesis; that bulk shippers increase shipments faster than can shippers.

Increasing volume per farm for both can and bulk shippers means a larger farm business, which requires increased inputs and a higher level of managerial capacity. These increased requirements are especially significant for bulk handling, paralleling the increased output.

Economies of Scale

Dairying requires a large fixed investment of a specialized nature. The rising cost structure and lower prices for dairy products appear to cause an expansion of the producing unit and adoption of improved technology in an effort to achieve economies of scale and maintain or increase the net income of the entrepreneur on a lower margin over unit costs.

Bulk handling of milk is a new technology with which the scale of operation is important. The question is no longer, "Does bulk handling pay?", but "How large an operation is necessary in order to justify bulk handling?". The range in responses to this question is indicated by the following two cases. An Oregon producer who was the first bulk shipper in that state answered, "With every-other-day pickup, I believe we can go down to ten cows". A California dairyman who had been shipping milk in bulk for five years replied, "Ninety cows".¹

It is impossible to establish an arbitrary level of production or herd size as that required before bulk shipment will

¹"Round Table: We Like Bulk Handling", Hoard's Dairyman, Vol. 10, No. 5 (November 10, 1954), pp. 24.

pay. James Robert Strain has developed tables showing increases in gross receipts with bulk shipment. Variables involve length of period considered; total price differential over can handling including premiums and changes in hauling rate; tank size; frequency of pickup; and daily production. He also developed tables showing the amount of capital that could be invested and still break even, using the same variables.²

Analyses must be tailored to the individual farm. Strain observed that patterns of adoption may be more a function of the stage of depreciation of current equipment than of producer size.³ However, cost per hundredweight of milk goes down with an increase in volume cooled and shipped by bulk methods. Investment per gallon of capacity decreases from \$9 to \$17 per gallon with 100-gallon tanks to \$5.50 to \$7.50 per gallon at 500-gallon capacities.⁴

Investment required for a bulk tank may be 50% greater than that required for cans and a mechanical can cooler of the same capacity. In addition, the tendency of milk producers to replace can coolers with bulk tanks of larger capacity adds to the amount of increase in total investment in equipment for cooling the milk.⁵

²James Robert Strain, "Adopting Indiana Dairy Marketing Structures to Farm Bulk Handling of Milk," (unpublished M.S. thesis, Purdue University, January, 1955), pp. 69-81.

³Ibid., pp. 86-87.

⁴Agnew, p. 37.

⁵Ibid., p. 39.

Specialization

Bulk tanks play a role in accelerating specialization in farming. The general farmer who kept a few cows for a steady income while selling hogs, wheat, corn, hay, eggs, and possibly several other products has been largely replaced by the commercial dairy farmer who markets his crops through his dairy herd. This dairy farmer is in turn being displaced by the specialized dairyman who raises only his roughage, if this much, and directs his time and management toward the care of his herd. At this writing there looms on the dairy horizon large-scale highly specialized "milk factories" with one or two thousand cows.

Fixity of Assets

The bulk tank is a part of the specialized capital investment which is required in order to operate at a level of efficiency which will maximize the net return from the product. The increasing economy to scale which it affords encourages an expansion of production to achieve maximum efficiency.

The dairy farmer of yesterday found it relatively easy to turn from dairying to beef, hogs, or crops if milk prices fell too low. Today, with his large investment in highly specialized equipment, he lacks this flexibility. The bulk tank is a highly specialized investment, and raises the proportion of fixed costs to total costs above that which existed when cans and can coolers are used. In addition, the expenses of housing, installing, and calibrating a bulk tank increase the differences between acquisition costs and salvage value.

Alternative opportunities exist for the dairy farmer; but these alternatives must be attractive enough to make up for the difference between the marginal value product of his specialized investments in the production of milk and their salvage value. Declining milk prices and rising costs have placed many smaller and less efficient producers in a position where the MVP of their investments are lower than salvage value. Alternatives here are: (a) To increase efficiency and thus reduce cost per unit of output. This might be done by increasing investments through the use of credit to raise the MVP of the total investment above acquisition cost; or (b) dispose of these investments at salvage value and seek other opportunities.

The addition of the bulk tank to the highly specialized investment required in dairying can increase the cost per unit of output to smaller producers. As long as the MVP of such a new investment is below its acquisition cost, the added outlay cannot be justified on an economic basis. In this situation the producer must continue with present equipment until: (a) changes occur in prices, costs, or both, which raise the MVP above acquisition cost, or acquisition cost falls; (b) alternative opportunities appear greater than the distance of MVP above salvage value; or (c) MVP drops below salvage value.

In cost terms, new investment would be made if expected returns with the new investment were higher than total costs, and higher than returns in alternative opportunities. Production would be maintained if returns were below total costs but above variable costs, and above returns in alternative opportunities. In this stage the firm would be "living on the inventory" and the inventory would decline. If returns drop

below variable costs the firm "couldn't make expenses", and rationally would cease production.

Labor and capital requirements

Michigan is a highly industrialized state, especially near the Detroit area. Earl Fuller showed that, with present farm organization and price relationships, the return to labor in dairy farming is too low to enable dairy farmers to compete with industry for labor resources.⁶ It has been necessary to combine increasing amounts of capital with available labor to increase the productivity of this labor. Combined with additional capital in the form of labor-efficient parlor and pipeline milking, the bulk tank is a link in an efficient system which can lower labor requirements per cow and per hundred-weight of milk and increase labor productivity. Increases in milk shipments shown by bulk shippers in the study are considered to result from increased inputs in the form of capital and management rather than labor.

The farm firm in the market

The individual farm firm by itself has little impact on or control over the market through which its product is sold; nor does it have much impact on the market from which it purchases its factors of production. However, the aggregate actions

⁶Earl Inman Fuller, "Some Michigan Dairy Farm Organizations Designed to Use Labor Efficiently," (unpublished M.S. thesis, Michigan State University, 1957), pp. 144-159, also Abstract of above, p. 4.

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... ..

the 1990s, the number of people in the world who are illiterate has increased from 1.2 billion to 1.5 billion. The number of illiterate people in the world is projected to reach 1.7 billion by the year 2015. The number of illiterate people in the world is projected to reach 1.7 billion by the year 2015.

• • •

of firms will have considerable impact upon both of these markets. The actions taken by an individual firm under the assumption of perfect competition may, in the short run, improve its relative position. The aggregate effects of actions taken by many individual firms may return each firm to a position comparable to that before the action. When these actions cause or continue overproduction, individual firms may find themselves in positions inferior to their original positions. Hence, the basic difficulty remains unresolved or even becomes more serious. The traditional assumption is that through the operation of the competitive system enough resources are withdrawn or forced from production to bring the volume of production into balance with what the market will absorb.

Many dairy farms are being withdrawn from production. However, many of their resources are being absorbed into larger, more efficient units, along with increased capital resources. The net effect is to maintain or increase aggregate production.

Response to price changes

During the period from 1953 to 1957 the total production of milk for the nation exceeded the normal domestic commercial utilization by about 5%.⁷

Michigan Milk Producers' Association reports production in the Detroit milkshed is increasing month by month and year by

⁷USDA, Agricultural Outlook Charts, 1958, Agricultural Marketing Service and Agricultural Research Service, (Washington, D. C., November, 1957), Table 80, p. 88.

year. The same thing is true in most other fluid milk markets in the country. However, while production is increasing, Class I or drinking milk sales in Detroit are continuing at approximately the same level.

The Association report mentions two conflicting theories concerning the effect of prices on milk production. One view is that lower prices force farmers to produce more milk to meet high fixed costs and maintain income. The opposing position is that high prices stimulate production, and that the way to reduce production is to reduce prices. In the first case, an increase in production caused by low prices would lead to still lower prices; on the other hand high prices would tend to maintain existing producers and even draw others into dairying.⁸ In the first case above, the assumed increase in aggregate production would not materialize if attractive alternative opportunities induced more than enough producers to withdraw from dairying to balance the increases in volume on remaining dairy farms. In the second case, even if milk prices increased, the inflow of resources and producers into dairying would be affected by the comparative attractiveness of alternative opportunities.

These views, coupled with the production increase related to the adoption of bulk tanks, point to an increasing surplus problem. Producers may be faced with the need for control of production, either cooperative and voluntary or governmental and compulsory.

⁸"June in January", Michigan Milk Messenger, Vol. X, No. 11 (March, 1959), pp. 8-10.

Relationship of bulk adoption to increased shipments

The adoption of bulk handling of milk is one of many changes taking place in dairying today. This study has shown that the adoption of bulk handling methods is related to a marked increase in the volume of milk shipped from the farms involved in the change. It has been suggested that a farmer installs a bulk tank, then tries to fill it up by increasing production. In some cases producers may be forced to adopt bulk handling in order to keep their market, and then add volume to help pay for the tank.

In the majority of cases, however, it is probably that rather than being the two factors in an isolated cause-effect situation, these two factors are among the effects of a larger causality. The ultimate effects of this causality, the cost-price squeeze, may be larger family dairy farms or, at the other extreme, giant corporate "milk factories". A continuation of the cost-price squeeze which makes increasing efficiency necessary for survival will tend to force milk producers toward the latter alternative. Government support and control programs, reflecting our present national social values, attempt to protect and retain the family farm as the basic agricultural unit.

Implications for the Hauler

The results of this study indicate that dairy farms in the future will be fewer, with larger shipments per farm. Time required for each stop on a bulk route is nearly the same, regardless

of volume; therefore, a minimum number of stops required to provide a load will mean most economical hauling.⁹ Fewer stops and larger shipments may allow the use of larger pickup trucks and the elimination of many country receiving stations and truck-to-truck reload points.

Cost studies indicate that truck operating costs per mile range about the same to somewhat larger for hauling milk by tank compared with can, for comparative truck sizes and loads. Cost savings, then, must include those from picking up larger loads of milk on the route, hauling more than one load daily, or from route reorganization.¹⁰

The use of pumps to load milk at the farm, and the responsibility for checking quality, measuring, and sampling mean that technical skill must replace brawn on the milk route. Haulers will expect remuneration for their higher level of skill and training. Fewer stops with larger quantities per stop may offer the means to maintain or increase hauler earnings.

Implications for the Market as a Whole

Milk producers who adopted bulk handling during the latter part of 1956 increased shipments nearly 15% during their first year in bulk. During a three-year period including the year before converting to bulk and the first two years of bulk shipment,

⁹Agnew, p. 29.

¹⁰Ibid., p. 26.

volume increased over 34%. During the same period, a sample of can shippers representing 76% of the shippers in the Detroit market as of January, 1959, increased shipments by 12.8%.

Bulk shippers in the study represented all those producers who used bulk handling in December, 1956, or about 5% of all shippers at that time. By January, 1959, 24% of all producers shipped milk in bulk.

Assuming that shippers increased production by 15% during their first year in bulk, widespread adoption of bulk handling, by stimulating production, might release a flow of milk which would flood the market. This problem appears more serious when it is noted that bulk shippers have increased volume nearly three times as much during a three-year period as have can shippers. A serious drop in milk prices might be expected if this continues.

Several factors work against the situations described above. Increases in milk shipments from shippers remaining in the market are partially off-set by a reduction in the number of shippers. Shipper numbers decreased 6.5% during 1958 alone. For example, it takes four 200,000 pound shippers, each increasing 15%, to balance the loss of one 120,000 pound shipper in any given year.

The effects which additional supplies have on price are modified by institutional factors such as Federal marketing orders and price supports, and the bargaining power of shippers' associations.

Opportunities for Further Study

Studies and discussions often raise more questions than they answer. This section discusses some of the questions which have arisen during the course of the study.

Seasonal Production Patterns

The bulk tank may cause dairymen to level production seasonally. The tank must be large enough to accomodate production during peak months. The levelling of peaks and valleys in production over the year would allow the use of a smaller, less costly tank for a given annual production, a higher proportion of tank capacity used, and a decreased cost per unit of output.

Daily base figures were obtained for the 63 bulk shippers who shipped to Association stations for the period of the study. Average daily shipments for each year were obtained from annual data. Daily base figures were divided into these to obtain a ratio. For shippers converting to bulk within one and two months of the end of the 1956 fiscal year and for the entire 63 shippers, these ratios increased to a peak greater than unity for the 1957 fiscal year, and then declined for 1958.

On the surface this appears to be counter to the reasoning advanced above. Actually, it is not. The base figures for 1957 are based on 1956 shipments. Bulk shippers increased their shipments in 1957 to 15% above their 1956 shipments. This gave a larger daily average to divide by the base in order to obtain the ratio. In addition, while increasing herd sizes dairymen may have been unable to maintain summer and fall calving.

The results of this analysis are insufficient. The following recommendations are suggested:

1. Obtain a larger sample.
2. Cover a longer time period; especially after the adoption of bulk handling.
3. Divide daily production by the base figure for the previous year. This will avoid the apparent paradox of the 1957 figures.

Size of Shipper Related to Time of Conversion

Bulk shippers have larger average volumes than can shippers. Due to the investment involved, the value of bulk handling is related to the scale of operation, and smaller shippers find it less practical or even impractical to adopt bulk handling. These facts lead to the expectation that the larger shippers will adopt bulk handling first, and that the size of converters will successively diminish.

It is not completely valid to assume that the larger bulk shippers in this study converted first and the smaller ones later, since receivers began receiving bulk shipments at different dates. However, with some exceptions, shippers converting later in 1956 tended to be smaller than those converting earlier.

The two receiving stations with the largest number of bulk shippers were examined. The largest showed no decrease in average shipper sizes as related to conversion dates. The other showed a slight decrease in size. All stations operated by the

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producers' association were grouped together; no overall decrease in shipper size was apparent.

Strain observes:

Most reports indicate no rhyme or reason in the order of initial adoption of bulk methods. Studies show that larger producers receive the greatest benefit from bulk adoption, but reports of actual installations show many moderate producers adopt the tank method before their larger neighbors. Possibly initial patterns of adoption are more a function of the stage of depreciation of current equipment than of producer size. Extremely small producers, however, have seldom been found to install bulk equipment readily.¹¹

In determining order of initial adoption of bulk handling as related to shipment volume, the following recommendations are made. Data should be taken from one receiving station, or from stations which began bulk receiving at approximately the same time. These should not be forced conversions or shippers facing a cutoff date for can shipment. A large enough sample should be obtained to furnish a sufficient number of observations for each month of conversion or other time period. A sufficient number of time periods should be allowed.

Characteristics of Drop-outs

This study does not consider those who discontinued shipments. While many small shippers expanded greatly, it can be assumed that much of the reduction in shipper numbers was due to smaller shippers who quit producing milk rather than increase the dairy enterprises.

¹¹ Strain, pp. 86-87.

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A study by Jones and Quackenbush indicated that two-thirds of the producers leaving the Detroit market during the last half of 1953 discontinued producing milk. About 30% of producers discontinuing milk production said that factors related to physical health were the most important reasons they discontinued milk production. Other reasons mentioned may have been related to the physical inability to care for cows. Reasons directly related to economic factors were given by about 55% of the discontinuing producers. Percentage of total farm income from the sale of milk indicated that most producers entering and leaving the market rely heavily on the dairy enterprise for farm income.¹²

With the heavy capital investments required for bulk tanks and associated facilities, two significant changes may be apparent in the characteristics of drop-outs. A higher proportion may be discontinuing shipments, and a greater proportion of those discontinuing shipments may do so because of economic factors.

Characteristics of Change Groups

The analysis of the data obtained in this study showed that the largest proportion of shippers increase production, while fewer decrease, others remain quite stable, and a small number show erratic patterns of shipment. This suggests an

¹²E. B. Jones and G. G. Quackenbush, "Milk Producers Entering and Leaving the Detroit Market During 1953", Special Bulletin No. 397, Agricultural Experiment Station, Department of Agricultural Economics, Michigan State College (April, 1955), pp. 3-4.

analysis of the characteristics of these groups. Of special interest are the groups which show shipments increasing 10% or more over the base period and also decreasing to more than 10% under the base period. Adding to the interest is the fact that the mean of this erratic group of bulk shippers is the largest of any bulk change group, while the mean of the erratic group of can shippers is the lowest of any can change group.

Short-run Shipment Changes at Time of Conversion

Many shippers in the study increased their volume of shipments prior to conversion, rather than only after conversion. Analysis of the bulk sample showed that increases were as great during the year before conversion as during the second year of bulk shipments, and both were greater than any annual increase by can shippers. This suggests an investigation of monthly shipment data covering several months or more prior to conversion as well as after the adoption of bulk handling.

APPENDIX A

STATISTICAL TEST OF SIGNIFICANCE

The hypothesis of this study states that milk shipment volumes from farms which adopted bulk handling increase more rapidly than shipment volumes from farms which continue to ship milk in cans.

The annual mean shipment volumes were obtained from the samples representing each of the two methods of shipment.

A linear regression line was plotted for each shipment method after each equation was obtained by the method of least squares. The linear equation used was: $\hat{y} = a + bx$, where $\hat{y}$ is the predicted y value for any given x value. The values of a and b for each line were obtained by the formulas:

$$b = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sum x^2 - \frac{(\sum x)^2}{n}} \quad \text{and} \quad a = \bar{y} - b\bar{x}$$

For each shipment method, x values were 1, 2, 3, and 4, representing the first, second, third, and fourth years of the study. The y observations were the mean volumes of milk shipments for each of the four years, for each shipment method. For bulk shipments, the y values were 192,422, 210,180, 240,918, and 258,737 pounds. For can shipments the y values were 133,150, 142,300, 147,336, and 150,318 pounds.

These regression lines, together with the observed y values, are shown in figure A-1.

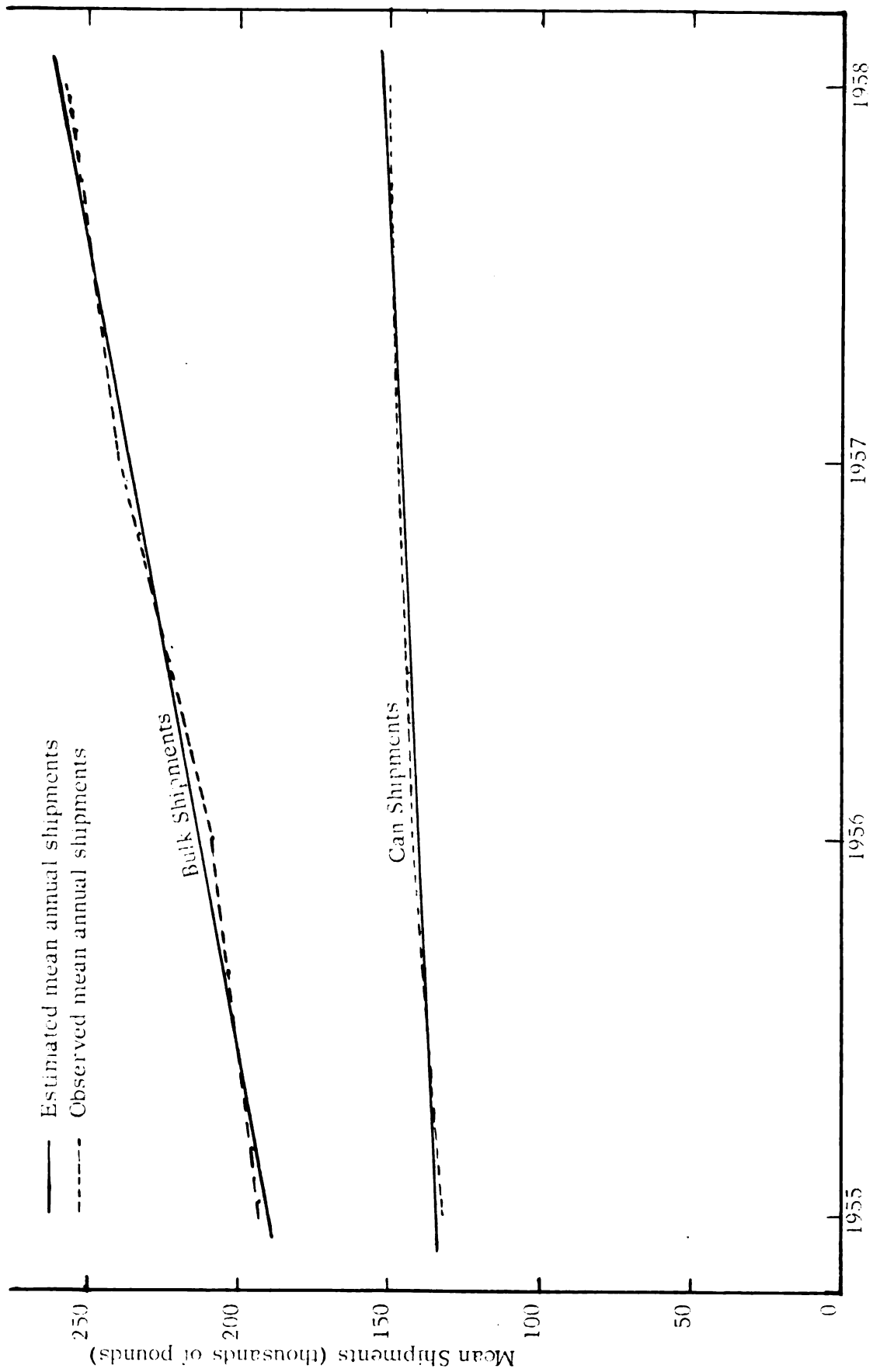


Figure A-1 Mean Observed and Predicted Annual Shipments for Can and Bulk Shipper Groups, Detroit Market, 1955-58

The regression lines obtained by this method represented the increase in shipments over the period of the study by each of the two methods of shipment. The t test was used to determine if the slope of the bulk shipment line was significantly greater than the slope of the can shipment line. The slope for the bulk sample was 22,968, and for the can sample 5,654.

The standard errors of estimate for the y values were obtained thusly:

$$\sigma_e = \sqrt{\frac{\sum y^2 - a\sum y - b\sum xy}{n - 2}}$$

The standard error of estimate for the bulk sample was 4052.8 pounds, and for the can sample 2204.9 pounds.

The standard deviation of the slope of the line for the bulk sample was 1812.5, and for the can sample 986. These were obtained by:

$$\sigma_b = \frac{\sigma_e}{\sqrt{\sum x^2 - \frac{(\sum x)^2}{n}}}$$

The standard deviation of the difference of the slopes, 2063.3, was obtained by:

$$\sigma(b_1 - b_2) = \sqrt{\sigma_{b_1}^2 + \sigma_{b_2}^2}$$

The t value was obtained by dividing the difference of the slopes of the two regression lines by the standard deviation of this difference:

$$t = \frac{b_1 - b_2}{\sigma(b_1 - b_2)}$$

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The resulting t value, 8.39, was greater than the t value with four degrees of freedom at the 1% level, or 4.604. Therefore the slope of the regression line for the bulk sample is significantly greater at the 1% level than the slope of the regression line for can shippers.

The hypothesis of the study is accepted; bulk shippers showed a significantly greater increase in shipments than can shippers during the period of the study.

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1. The first step in the process of creating a new product is to identify a market need. This involves conducting market research to determine what consumers are looking for and what problems they are trying to solve.

2. Once a market need has been identified, the next step is to develop a concept for a product that meets that need. This involves brainstorming ideas and creating a prototype.

3. The third step is to conduct a feasibility study to determine if the product is viable. This involves analyzing the market, the competition, and the costs of production.

4. If the feasibility study is positive, the next step is to develop a business plan. This involves outlining the marketing strategy, the production process, and the financial projections.

5. The fifth step is to secure funding for the product. This can be done through a variety of methods, including venture capital, angel investors, and crowdfunding.

6. Once funding has been secured, the next step is to begin production.

7. The final step is to launch the product and begin marketing it. This involves creating a marketing plan and implementing it.

8. After the product has been launched, it is important to monitor its performance and make adjustments as needed. This involves tracking sales, customer feedback, and market trends.

9. The final step in the process is to evaluate the success of the product. This involves comparing the actual results to the goals set in the business plan.

10. If the product is successful, the next step is to consider expanding the product line or entering new markets.

11. The final step in the process is to continue to innovate and develop new products to meet the needs of the market.

12. The final step in the process is to continue to monitor the market and make adjustments as needed.

13. The final step in the process is to continue to innovate and develop new products to meet the needs of the market.

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