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ALLEN, R H. HOLE, E. NICHELL, R L 1 OF 1

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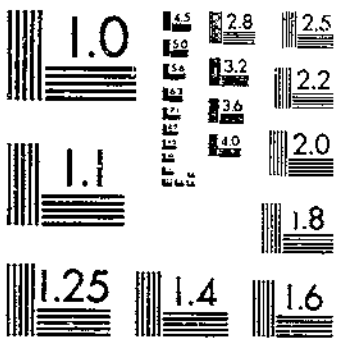

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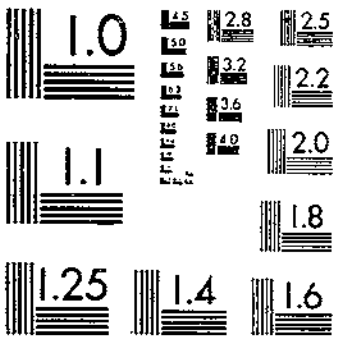

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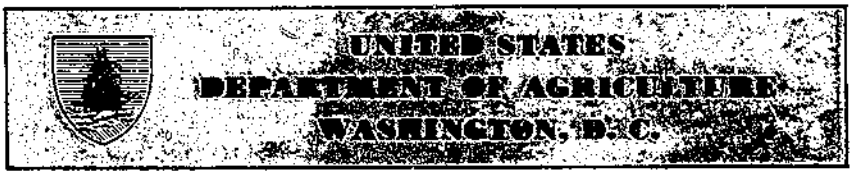

Supply Responses in Milk Production in the Cabot-Marshfield Area,[1] Vermont

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INTRODUCTION

Studies of supply response, or what is sometimes called the elasticity of supply, are not new. Much research has been conducted on this problem in the 15 years since it was said that "one of the many unexplored portions of the field of economics is the relation between price and subsequent output" (*8, p. 146*).[3] Studies of farmers' response to price and other factors have dealt with a considerable number of farm products. Hogs, cotton, flax, and milk are mentioned as examples[4] (*1, 8, 15*).

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[2] This study was planned by Sherman E. Johnson, representing the Bureau of Agricultural Economics, John A. Hitchcock, representing the Vermont Agricultural Experiment Station, and John D. Black, representing the committee on research in the social sciences of Harvard University. The field work was directed by Ronald L. Michell and John A. Hitchcock. The analyses were made jointly by the authors in Washington and by Ross V. Baumann, Delbert C. Myrick, William H. Nicholls, and Charles R. Sayre, working under the direction of John D. Black at Harvard University.

[3] Italic numbers in parentheses refer to Literature Cited, p. 56.

[4] EZEKIEL, MORDECAI; RAUCHENSTEIN, EMIL; and WELLS, ORIS V. FARMERS' RESPONSE TO PRICE IN THE PRODUCTION OF MARKET MILK. U. S. Bur. Agr. Econ. 16 pp. May 1932. [Mimeographed.]
WELLS, ORIS V. FARMERS' RESPONSE TO PRICE: A SELECTED BIBLIOGRAPHY. U. S. Bur. Agr. Econ. 28 pp. April 1933. [Mimeographed.]

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Despite numerous qualitative references to the longer-term aspects of supply, major attention in these studies has been centered on relatively short-term responses requiring only a year or so at the most. Nothing that has been done on the subject has given us any way of estimating what supply of any farm product will be forthcoming, say 10 years later, if its price should definitely rise (or fall) to a level 15 percent higher (or lower) relative to other prices, and producers had reason to believe this change permanent. This type of question is significant in connection with changes in transportation costs, tariffs, bounties, and nearly all matters affecting economic policy extending over time.

A principal reason for the lack of progress in the analysis of long-time-supply response in contrast to that made with short-time supply, is that appropriate research methodology has not been developed to the same degree. The special type of statistical analysis of time-series data that has been so fruitful in dealing with short-time response cannot be appropriately applied to the derivation of long-time-supply schedules. This is because past experience frequently has not covered the full range in prices in which one is interested and, even if it has, the prices have not remained for a sufficient time in each significant portion of the range so that the time-consuming adjustments to these prices really could take place. Furthermore, it appears that long-time responses are to a considerable degree irreversible. That is to say, once commitments have been made in any given direction, they cannot lightly be abandoned should prices change. Hence, even the normal long-time response depends somewhat on what has gone before.

A general basis for an appropriate attack on problems of long-time response in relation to interregional competition has been described by Black (*4*). A somewhat similar approach is also suggested by Working's comment (*6, pp. 95–96*). The writers' own consideration of the problem is explained in Analysis of Interregional Competition in Agriculture.[5]

Very briefly, the procedure is a twofold process of first carefully analyzing developments and trends over the immediately preceding period and then estimating for several possible levels of price for the commodity in question how much is likely to be produced at a time several years in the future. The analysis may proceed on several levels of intensity with respect to both of these phases. At the lowest level it may be in very general terms, as when broad economic movements are described and their probable future direction is forecast. Thus we might examine data on total milk production in the United States over a series of years, attempt to explain qualitatively why certain variations or trends appear, and then attempt to project the probable future production. A somewhat more penetrating level of analysis would be one in which the total United States data were broken down by regions and type-of-farming areas and reasons sought to explain the changes in each area. Projections for these small areas when added would give a more dependable total estimate.

The method attempted in the study here reported is on a still more intensive basis with respect both to the examination of the past trends and their causes and to prospective responses from different prices.

[5] JOHNSON, SHERMAN E., HADY, FRANK T., MIGHELL, RONALD L., ALLEN, R. H., and HOLE, ERLING. ANALYSIS OF INTERREGIONAL COMPETITION IN AGRICULTURE. U. S. Bur. Agr. Econ. 74 pp. April 1939 [Mimeographed]

By means of individual farm records and other data the past period is carefully examined farm by farm in a representative area. Net changes over the period are noted and explained. For the period ahead individual farm estimates are prepared for each of three price levels. The area summations of the individual estimates are further adjusted for certain factors which cannot be treated by individual farms. The final result can be presented as a long-time-supply schedule for the area showing the probable output for each of the several levels of price for milk for a time some years ahead.

The possibilities of throwing light on farmers' long-time price responses by means of detailed studies of changes in the organization and practices on the individual farms of an area have not been explored to any considerable extent by agricultural economists. In Pennsylvania, an area, Chester County, has been studied, using detailed individual farm data at three successive periods, 1912, 1922, and 1930–31 (*9*, *11*, *16*). These studies had as their chief objective the determination of the factors affecting farmers' incomes during each of the years studied. Similar relationships between significant factors and financial success were found. For example, number of cows per farm, production per cow, and crop yields were positively correlated with labor income. In each study it was pointed out that farmers with small herds usually did not make as good an income as did farmers with larger herds and similarly with the other two factors. The presence of these same relationships in each of the years studied has even been interpreted by some to mean that little was accomplished in the way of adjustments in farm organization and practices during the entire 20-year period even with these studies showing the way. Although the most recent study gave passing attention to the changes since 1912, the analyses were not made in such a way as to describe clearly the changes in price relationships and other economic factors to which the farmers were responding and the extent of either individual or group responses to these changes. Hence such conclusions cannot be accepted without additional factual evidence.

Some work of much the same character has been done in New York in studies covering northern Livingston County (*21*). Surveys were carried on in this area for the years 1908, 1918, and 1928. While more attention was given to comparing the data for the 3 years, and thus describing trends than was the case in the Pennsylvania studies, primary attention was directed toward factors associated with high incomes in each year and comparisons of these relationships between years.

In the present study more attention is devoted to the process by which changes in the production of a given area come about. If we look at the history of agriculture in New England we find a continuous record of adjustment to new situations. The early settlers were of necessity almost entirely self-sufficient. However, as the urban population increased, a commercial agriculture became possible. It consisted chiefly of the production of feed crops for sheep, cattle, and hogs, and some grain for human consumption. Sheep and cattle could be driven considerable distances to market. With the building of railroads, the opening up of the Ohio and Mississippi Valleys, and the development of farm machinery, grain, meat, and wool began to reach the eastern markets in such quantities that New England farm-

ers found it difficult or impossible to maintain their incomes at the prevailing prices.

The peak in the development of New England agriculture in terms of number of farms was probably reached prior to 1880. A long period of retrenchment and readjustment to a less favorable price situation followed.

With the industrial and commercial development of New England, farmers had the opportunity to shift from the production of staple products such as grain, wool, and meat to the production of more perishable and bulky products for the nearby markets, thereby offsetting in part at least the adverse effects of western competition. Adjustments in this direction have been in process almost continuously for half a century. In Vermont there was first a development of butter production. Then butter production expanded tremendously in the Midwest. More recently Vermont became a part of the cream-producing area for southern New England markets, and then still more recently it came into the fluid-milk-supply area.

This brief sketch is sufficient to indicate that the agriculture of New England has been continuously changing in character in the 200 years of its existence. At the present time forces are at work which are almost certain to result in still further changes. Dairy production is increasing in many sections, and dairy farmers are becoming more highly specialized. The agricultural conservation program has been focusing attention on practices that build up the productivity of cropland and pastures.

What do these changes that are under way mean in terms of the organization of agriculture 10 years hence? What will be the relative competitive positions of dairy farmers in northern New England and in the Midwest? What adjustments should dairy farmers as individuals make during the next few years? These are some of the questions toward which the work reported in this bulletin has been directed. It will not answer all of them, but it is a first step in a larger undertaking which has as a major objective the development of a better basis than we now have for answering them.

The larger study of which this is a part relates to interregional competition in the production of dairy products in the New England and midwestern dairy regions taken as units. This particular part of the larger study relates to two adjacent towns in northern Vermont. These two towns are representative of a particular type of producing area. Other similar studies are in progress in other types of producing areas in each of the two regions mentioned. A next step would be to combine supply schedules for these areas in order to arrive at composite supply schedules for each region. By bringing together these regional supply schedules and relating them to the appropriate demand schedules, long-time estimates of production and prices might be made. This would make it possible to set forth with more assurance the adjustments that farmers in the several areas should make. The planning of marketing would also be aided by these long-time estimates, as would in fact all programs relating to the production and distribution of the commodity in question.

One of the reasons for selecting the Cabot-Marshfield area for detailed study was the fact that a study of dairy farming was carried on here in 1926. With this as a basis it has been possible to describe in

detail and to explain the changes that have taken place on individual farms and in the area as a whole since that time. The value of such an analysis lies in the fact that a forecast of the future is much more reliable if we can project a considerable number of causal factors and derive the expected result from them than if we merely project trends of the resultants. For example, we would expect to forecast milk production more accurately by considering trends in number of cows and production per cow than by considering trend in total production alone.

Such detailed studies of past trends have uses in addition to the more specific one described here. They are useful in explaining the present organization of production, and thus in shaping public policies relating to agriculture as well as furnishing guidance for individual farmers in working out their plans for the future.

THE AGRICULTURE OF NORTHERN NEW ENGLAND

Dairying is the primary agricultural enterprise of northern New England. An area extending over Vermont, New Hampshire, and southern Maine produces the greater part of the fluid-milk and cream supply of Boston. Within this milkshed the greatest concentration of dairy farms and milk production is found in Vermont. The importance of dairy production in this State is indicated by the type-of-farming classification set up in the 1930 census (*18*). Dairy farms accounted for 75 percent of the total value of the production on all farms in Vermont. Farm enterprises other than dairying were usually supplementary to dairying. Dairy farms were more numerous than any other type in every county in the State.

In New Hampshire, dairy farms accounted for somewhat less than half of the total value of farm products. Although they were more numerous than any other type except in one county, less than half of the farms were dairy farms. On many farms not classified as dairy farms, however, dairying is the principal source of cash income from farming.

In southern Maine the position of dairying is similar to that in New Hampshire. Supplementary enterprises are relatively more important than in the other two States.

If we look backward over the last 40 years and examine the historical changes in dairy production in this northern New England area we can make two general observations: (1) Total milk production appears to have fallen off and then recovered, and (2) a significant shift from butter to fluid-milk and cream production has occurred.

Let us first consider the changes in total milk production. If one examines the data in the several United States censuses, it appears that the production of milk reported for each of these States in 1899 was greater than that reported by any subsequent census. Variations in census procedure resulting in a more nearly complete enumeration of farms in 1900 may have been responsible for a part of this increase (*5*). Furthermore, farmers' replies to the census question on milk production may have been influenced by the shift from butterfat to fluid-milk production. Dairymen who produce a continuous supply of fluid milk may tend to give more conservative replies than those producing cream with a higher seasonal swing in production.

Making due allowance for these sources of error in the data, however, there still seems to have been something of a peak in production near the turn of the century which was not equaled until recent years, and probably not even then in Maine and New Hampshire.

Changes in dairy-cow numbers since 1920 as estimated by the Bureau of Agricultural Economics may provide a better basis for estimating the trend in milk production in recent years than the census, although these estimates are also based in part on census data.[6] Numbers of dairy cows in Vermont are now (1939) estimated to be about at the same level as in 1920. In Maine and New Hampshire

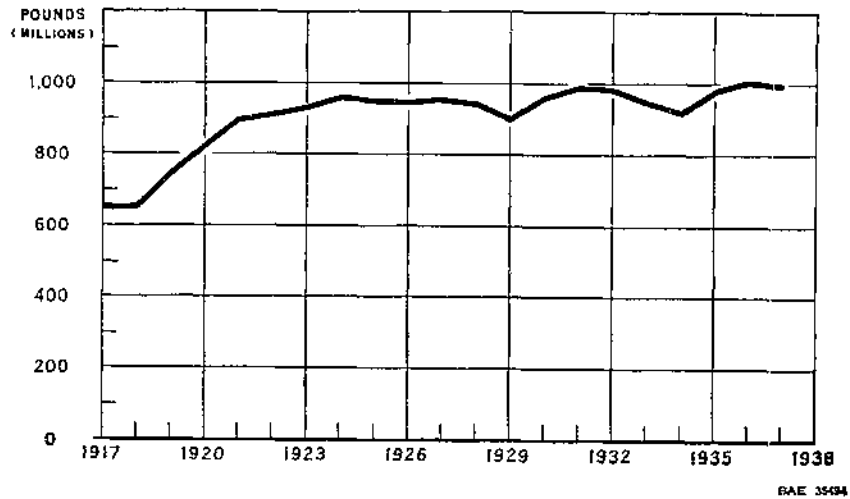

FIGURE 1.—TOTAL RECEIPTS OF MILK AND CREAM BY VERMONT DAIRY PLANTS 1917–37 (MILK EQUIVALENTS).

The trend of receipts of milk and cream by Vermont plants has been upward since 1917 with one break in 1928 and 1929 and another in 1933 and 1934. The apparent sharp increase during the early portion of this period may be in part the result of more complete reporting after the first few years. (Butterfat in cream converted to whole-milk equivalents on the basis of 4 percent butterfat content which was the approximate average for the State.)

there appears to have been a slight decrease. Some falling away in numbers during the 1920's has been followed by a rise toward the earlier level.

A third source of information on milk production in Vermont is found in the records of the Vermont Department of Agriculture. These show the total quantities of milk and cream received from farmers by Vermont dairy plants from 1917 to 1937.[7] Butter made on farms, which was somewhat more important in the earlier years, would not be included in these data. Inspection of this series in figure 1 leads one to conclude that there has been an increase in total milk production in Vermont over this period.

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[6] [UNITED STATES] BUREAU OF AGRICULTURAL ECONOMICS. LIVESTOCK ON FARMS, JANUARY 1, 1867–1935, REVISED ESTIMATES, NUMBER, VALUE PER HEAD, TOTAL VALUE. 137 pp. January 1938. [Multilithed.]

[7] Since 1924, with the exception of 1928, these have been published by counties in the biennial reports of the Vermont commissioner of agriculture. Data for the years prior to 1924 were secured by the Bureau of Agricultural Economics directly from the files of the Vermont Department of Agriculture. The 1928 data were published later in a separate pamphlet. In the 1930–32 report revised data for 1929 were included.

Let us turn now to a consideration of the second and perhaps more significant shift from butter manufacture to the production of fluid milk and cream. Back in 1899 the supply of milk and cream for Boston came chiefly from Massachusetts and southern New Hampshire (*14, p. 8*). In northern New England, butter was the principal dairy product. Farm butter was more important than creamery production in Maine and New Hampshire, but less so in Vermont. Since 1900, butter making has steadily declined in all three States and sales of fluid milk and cream have increased. In the shift toward fluid milk and cream, the relative position of the three States has remained much the same. Vermont, if anything, has become a slightly more important source of milk and cream relative to New Hampshire and Maine than was formerly the case for butter.

Although the transition has been continuous, as late as 1921 almost as much of the milk produced in Vermont was used to make butter as was shipped to Boston as milk and cream.[8] By 1937, however, creamery butter production in Vermont was only 3,244,000 pounds, or about one-fifth as much as in 1921. A similar change occurred in Maine and New Hampshire.

According to the Vermont commissioner of agriculture's report of deliveries of milk and cream at creameries and receiving stations in Vermont, about 60 percent of the deliveries were milk in 1924. By 1937 milk made up 90 percent of the total. Thus there has been a major shift from cream to milk deliveries during a comparatively recent period. This shift has been much the same in all counties in Vermont except on the western side of the State which shifted to milk earlier in response to the expansion of the New York market.

The Cabot-Marshfield Area

The area covered by the towns of Cabot and Marshfield is in the northeastern portion of Washington County in north-central Vermont. It is centrally located in the Central Plateau. This is a rather high (1,200 to 2,000 feet) plateau extending the full length of the State just east of the Green Mountains and including about one-third of the total area of Vermont (fig. 2). This plateau is dissected with narrow stream valleys and flattened ridge tops (fig. 3). In the northern part the valleys are shallower and broader and the ridge tops are broader and smoother than in the southern part. The Central Plateau is the largest agricultural area of the State. It is highly specialized in dairy farming especially in the northern part, only the Champlain Valley having more concentrated dairy production in the State. Maple products, wood and timber, potatoes, and poultry products are supplementary enterprises on many farms and hence secondary sources of income.

The rail distance from Marshfield to Boston is 189 miles. Motor-truck and rail shipments of milk and cream to Boston are of approximately equal importance. Trucking is apparently more important here than in most other parts of Vermont because a number of important receiving stations, including that at Cabot, are off-rail. Although the major part of the product is shipped as fluid milk, fluid-cream ship-

[8] Creamery-butter production in Vermont was reported as 14,919,000 pounds in 1921 (U. S. Dept. Agr. Yearbook). This is equivalent to 145,728,792 quarts of milk (1 pound of butter equals 2.442 gallons of milk). Rail receipts of milk and cream in Boston from Vermont in 1921 amounted to 152,744,000 quarts of milk equivalent (Mass. Dept. Pub. Util. Rpts.).

ments are also important. One plant serving this area takes cream only, and uses it exclusively in butter making. Several other plants are equipped to make butter when surpluses occur.

In 1935–36 there were at least seven receiving stations to which Cabot-Marshfield farmers sent milk or cream. Considerable overlapping in collection routes in the two towns was found. Many of

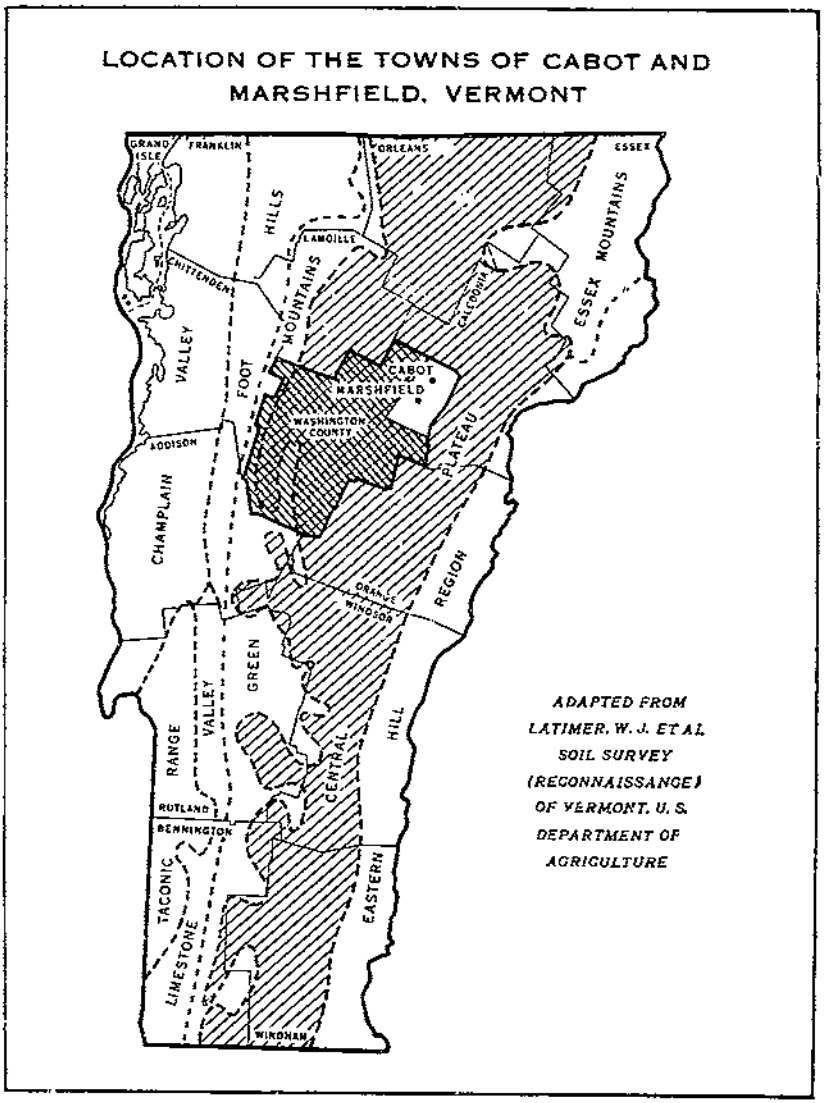

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FIGURE 2.—The adjacent towns of Cabot and Marshfield in the northeastern part of Washington County are centrally located in the northern part of the Central Plateau of Vermont. These towns include the two villages with the same names the locations of which are indicated.

those selling cream delivered their own product, as did those selling milk and living within 3 or 4 miles of receiving stations.

Cabot and Marshfield together comprise an area of 48,108 acres. Their total population in 1930 was 1,979. They are essentially rural

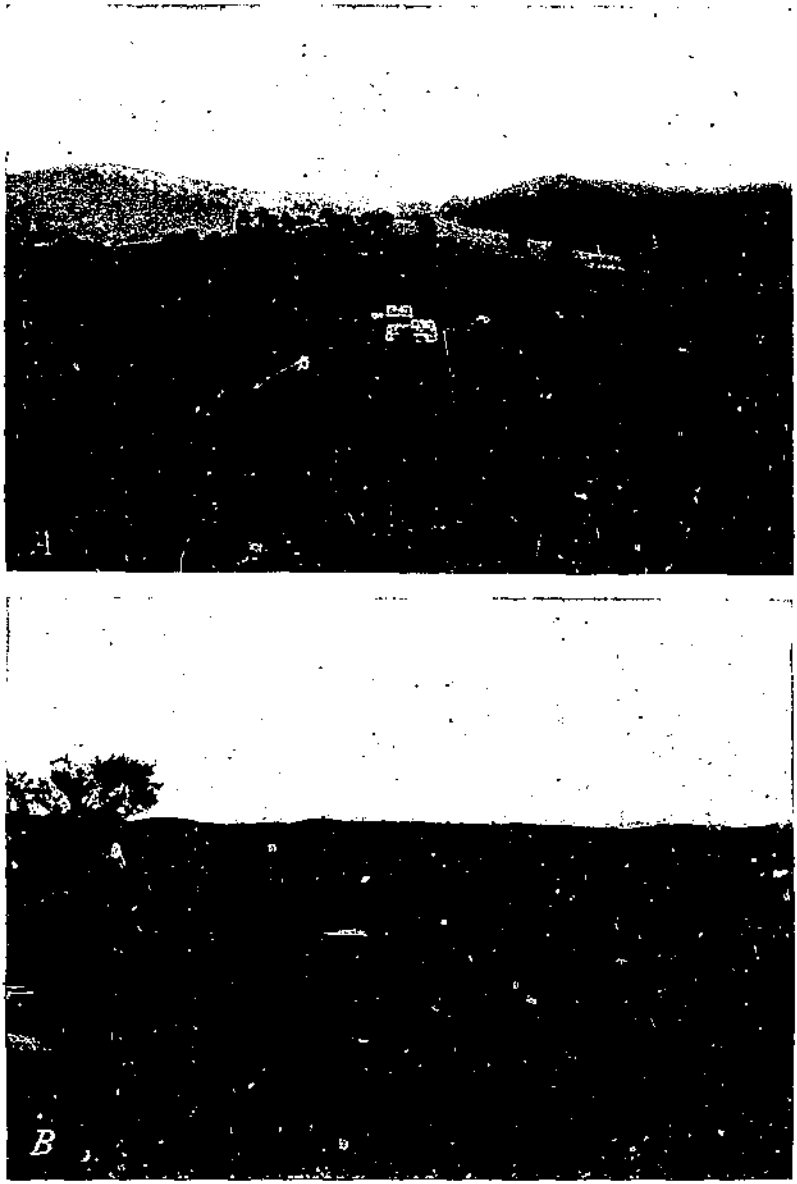

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FIGURE 3.—TYPICAL LANDSCAPES OF THE CENTRAL PLATEAU OF VERMONT.

A, Farm in a relatively hilly area; *B*, rolling topography with more moderate slopes and flattened hilltops.

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towns, each with a village occupying the position of social center and servicing point for the surrounding agricultural area. Marshfield is on a railroad line, but Cabot is not. The village of Plainfield, also with rail connections, serves farmers in the south part of Marshfield.

The topography of Cabot and Marshfield is hilly. The eastern portion of Marshfield is largely rough and mountainous and is unsuited for farming. Most of the remaining area is included in farms and is used for cropland or pasture. The hill soils are chiefly loams and silt loams, while the valley soils are lighter in texture. The Calais and Greensboro soil series predominate, and most of the area is of the stony phases of these series.

TRENDS IN PRODUCTION SINCE 1926

In this section recent changes in milk production in the Cabot-Marshfield area are described and explained. A careful study of trends in production and of the factors determining the nature of these trends is essential in any attempt to evaluate the effects of various factors upon production in the future.

General Characteristics of the Period

A study of farm organization and management in this area was made by the Vermont Agricultural Experiment Station in 1926. Two bulletins presented the results of this study (*2*). Farm records were obtained covering the year ended October 31, 1926.[9] Comparison of the data thus obtained with those of a study made 10 years later affords a basis for describing in considerable detail the changes that occurred in the interim. The significance of such a comparison depends to a considerable extent upon the representativeness of each of the years in question of the immediate period from which it is selected. It also depends upon the extent to which trends were consistently in one direction during the decade under consideration.

Figure 4 shows trends in combined milk and cream deliveries and in prices of butterfat and grain since 1921. The butterfat price is the average received by a representative group of producers without regard to whether sales were in the form of cream or milk. As there was a considerable shift from cream to milk deliveries during the period, further consideration will be given to the effect of this shift upon the average price received and upon farm incomes. Butterfat prices were relatively stable during the early years included, but from 1925 to 1930 there was a substantial upward trend. Deliveries increased from 1927 to 1931, especially during the latter part of 1929 and most of 1930 when the shift from cream to whole milk was taking place. The trend in grain prices was upward although it dipped sharply midway during the period.

During the early 1920's nearly all of the farmers sold their product as cream, and it was converted into butter by the local creameries. But the expansion of the demand of the Boston market for milk and cream brought about a shift from butter making to the shipment of fluid milk and cream beginning during the late 1920's. Whole-milk deliveries to the creameries were made not only to supply the fluid milk for shipment but also most of the cream as well.

[9] Copies of the original farm records are kept at the Vermont Agricultural Experiment Station and were made available for use in the present study.

The Cabot Cooperative Creamery, most important receiver for this area, began buying milk in 1929 in order to enter the fluid milk and cream market of Boston. Likewise the Marshfield Cooperative Creamery (purchased by David Buttrick, Inc., in 1929) began to buy milk at about the same time. In 1927 H. P. Hood & Sons had opened a receiving station in Plainfield and encouraged the farmers to deliver milk rather than cream. The Buttrick plant in East Montpelier and Deerfoot Farms Co. at Plainfield began to receive whole milk as early as 1924 but paid for it on a butterfat basis at the same rate as

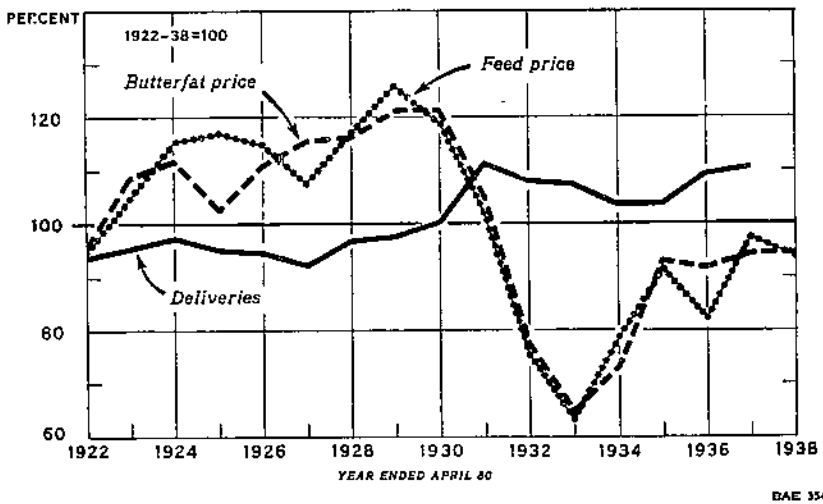

FIGURE 4.—INDEXES OF MILK AND CREAM DELIVERIES AND BUTTERFAT AND FEED PRICES, CABOT-MARSHFIELD, 1922-38.

The price paid by Cabot-Marshfield farmers for feed and the price received for butterfat have moved together during most of the years since 1922. Deliveries increased rapidly during the late 1920's, fell off after 1931, and in 1936 and 1937 again reached the 1931 level.

for fat in cream. The important shift from cream to milk deliveries in this area began in 1927 and reached its height in 1929 and 1930. Since then there has been some shifting back and forth by individual farmers. In 1936, 81 percent of the deliveries from the farms for which records were taken were in the form of whole milk. During the following year there was an increase in cream deliveries and a decrease in milk deliveries.

Figure 5 furnishes a basis for comparing prices paid for cream and for milk during the period in which sales in both forms were important. The two series represent prices paid by the same creamery. This creamery trucked milk and cream to Boston and also made butter. All patrons received the same price for butterfat at each pay period, but the weighted average annual price would vary slightly from patron to patron, according to the seasonal distribution of production. The milk price here shown is for only one producer. During the time in which base ratings were in effect it would vary with the ratio between base rating and excess milk as well as with seasonal distribution as such. Such series constructed for a number of individual producers

showed relatively little variation; hence this one may be considered as fairly representative.

During the period from 1930 to 1938 the price differential between milk and cream varied from 7 to 12 cents per pound of butterfat, or from 28 to 48 cents per hundredweight of 4-percent milk. A typical producer had to pay 15 cents per hundredweight for having his milk hauled to the creamery and 2 cents per pound of butterfat in cream. The latter rate is equivalent to 8 cents per hundredweight of milk. Thus there is a savings of 7 cents per hundredweight in selling cream. Deducting this from the above differential reduces it to a range of

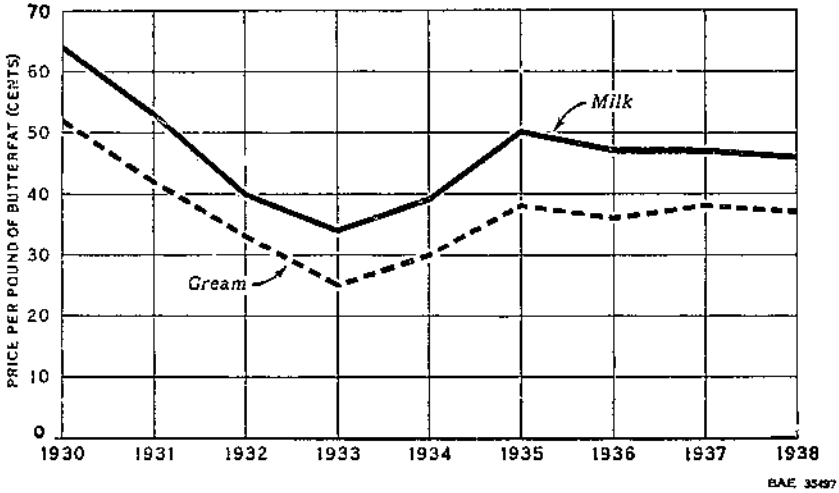

FIGURE 5.—PRICES RECEIVED FOR MILK AND CREAM AT ONE CREAMERY, CABOT-MARSHFIELD, 1930-38.

The milk price is that paid one producer; the cream price is for all deliveries of sweet cream. Both are unweighted averages of monthly prices. The margin between these representative series of milk and cream prices has varied from 7 to 12 cents per pound of butterfat during this period. This difference represents the return which the farmer gets for the skim milk and for the extra trouble and expense involved in producing and delivering whole milk.

21 to 41 cents on an annual basis over the 9-year period covered. If we disregard any differences in labor and investment involved, this may be taken to represent the return for the skim milk in 100 pounds of whole milk. It should be remembered that these are not average figures for all producers in the area, but rather are representative of a typical situation. The creamery with the specialized butter market was not chosen because it represents a rather unusual situation for northern Vermont. The point to be emphasized is that at some times during this period it was probably more profitable to sell cream and at other times milk. Likewise some farmers may more advantageously sell cream at the same time that others will get a greater return by selling milk. Comparisons of incomes on farms selling cream and those selling milk will throw more light on this question. Such comparisons are made later in the discussion of farm-management factors.

The depression period was characterized by a sharp decline in both milk and feed prices, accompanied by only a slight decline in deliveries. Milk and feed prices began their recovery in 1933–34 but have not yet regained their predepression levels. Deliveries, on the other hand, were above the level of the 1920's throughout the depression and have returned to about the 1930–31 level.

In using the data that are available for two separate years, one before and one after the occurrence of these various changes, it is important to consider the representativeness of the particular years. The year 1926 was prior to any significant shift from cream to whole milk sales. Deliveries during the record year were slightly below the level of the early and middle 1920's. This is not shown clearly in figure 4 since these data are computed on a crop-year basis beginning May 1, while the records were obtained for the year beginning October 1. The low point in deliveries occurred during the summer and fall of 1926 and hence was reflected in the average for 1927 in figure 4. At least two factors appear to be contributing to this decline in production. Most important, the milk-feed-price ratio had been declining during the three years immediately preceding. The construction of a dam in the area offered employment which probably drew some labor from the farms.

The year 1936 represents fairly well the level of milk deliveries since the depression. The milk-feed-price ratio was more favorable during that year, as a result of low feed prices, than during the years immediately preceding and following. It is impossible to say very much about the representativeness of a current year in a period of rather rapid price fluctuations. It may be well to keep in mind that the 1926 production data are perhaps 2 or 3 percent too low as a base, and that feed prices were unusually low in 1936. These low prices may have tended to increase the rate of grain feeding and production per cow, although this is not evidenced by a higher level of production as compared with the year preceding and the year following. Despite the limitations pointed out in this and the preceding paragraph, comparisons between the two cross sections may be expected to indicate the nature and approximate magnitude of the basic changes that have occurred.

Individual Farm Data Used as a Basis for Comparisons

In the 1926 study, farm records were obtained from 138 dairy farmers in the towns of Cabot and Marshfield. These farms included 51.1 percent of the total land area of the 2 towns. The census of 1930 reported 300 farms, including 84.4 percent of the total land area. This gives only a very rough basis for estimating the completeness of coverage of that study. Not all farms included by the census would be considered as farms for the purposes of that study.

Ten years later another study was made in the same area in which records were obtained from 207 farms. The following year, 1937, in going back over the same area 15 more farms were added to the list, making a total of 222 farms. These 222 farms included 74.9 percent of the total area. Of these farms, 7 were excluded from subsequent tabulations because 5 were definitely out of commercial production and 2 were mainly trading businesses. The remaining 215 are used

unless otherwise noted. This represents a more complete coverage in the later study than in the earlier one, rather than an increase in number of farms and land in farms during the 10-year period.

In 1926 the farm records were obtained for a 12-month period ended September 30 of that year. In 1936 a 12-month period ended April 30, 1936, was covered. In the subsequent discussion these 2 years will be referred to as 1926 and 1936, respectively. For most purposes the calendar difference between the records for the 2 years does not affect their comparability.

As the two studies were not equally complete, comparisons of totals for the area cannot be used to indicate trends during the 10-year periods although certain averages may be comparable. The only possibility for comparing totals lies in identifying the 138 farms included in 1926 among the 1936 records and thus comparing production on identical farms at the beginning and end of the period. If these farms had all remained intact this would have been comparatively easy but this was not true. Farms had been broken up and recombined in different ways in enough instances to change considerably the ownership pattern. Of the original 138 farms, 15 had been abandoned or combined with other farms so that they were no longer operated as separate units. Many of the remainder had undergone considerable changes in acreage. Three farms could not be used because of inadequate data in the later study. This left 120 farms for which total production could be compared as between the 2 dates. On 1 of these farms there were 5 cows in 1926 and none in 1936. In the latter year the hay was sold. This farm has been included in all subsequent tabulations for this group. The acreage of these 120 farms was 22,022 in 1926 and 22,198 in 1936—less than 1-percent change, despite the many transfers of land between farm units.

The number of cows on these 120 farms was 1,677 in 1926 and 1,770 in 1936, a 5.5-percent increase. Milk production on a butterfat basis increased 11.5 percent, indicating an increase in production per cow. This increase in total production may be compared with a 16.6-percent increase in deliveries of butterfat per farm for the area as calculated on the basis of the available data on deliveries at all creameries serving the area (*10*). Twenty-nine producers, for whom continuous records of deliveries over this period were available, increased 9.2 percent. Hence it appears that these 120 farms may have been fairly representative of the area with respect to trend in milk production per farm. The effects of changes in number of farms must also be taken into consideration. As the number of farms was actually decreasing we are mainly interested in the effects of farm abandonment in this connection. The process of abandonment will be treated in some detail later. No significant tendency to return abandoned farm land to use has occurred even during the depression.

The new records obtained in 1936 were for farms that were omitted for various reasons in the 1926 study. Of these, 8 had no cows and the remainder averaged only 10.2 cows per farm as compared with 14.8 cows per farm in 1936 on the 120 farms that were included in both studies. Evidently the earlier study was more incomplete in the enumeration of small farms. Hence comparisons on the basis of the 120 farms, while fairly representative of the larger farms in the

area, are not representative of the area as a whole to the extent that the smaller farms have not moved in the same direction nor as far as larger farms. However, as the 120 farms included 67 percent of the cows on the 215 farms in 1936, trends on these farms were of dominant importance.

Farm Production and Practices

Attention has already been called to the increase in milk production and sales coming about in part as a result of an increase in number of cows and in part of an increase in production per cow. It may be well to inquire further as to the way in which this has been accomplished. Table 1 makes a comparison of rates of feeding and milk production in the two periods. Pasture is not included since there is no reliable basis for its measurement but there appears to be no reason for expecting nutrients per cow derived from this source to have varied materially between the 2 years.

Table 1.—*Feeding and milk production per cow on 120 identical Cabot-Marshfield farms in 1926 and 1936*

Item	1926	1936	Item	1926	1936
	Pounds	*Pounds*		*Pounds*	*Pounds*
Total digestible nutrients in concentrates	1,033	1,119	Total digestible nutrients in succulent roughage	373	401
Total digestible nutrients in dry roughage	2,532	2,074	Milk production (4-percent-fat basis)	4,770	5,039

The data presented indicate that total nutrients fed in the barn decreased from the beginning to the end of the period while production per cow increased. The quality of the ration appears to have been somewhat improved as a result of a larger proportion of total nutrients from concentrates and succulent roughage. However, it should be noted that the possible error of estimate in the case of roughage may be relatively large. The tonnage is of necessity based on estimates, for roughage is seldom weighed on these farms. It is also quite possible for bias to enter into the figures as a result of the enumerator's ideas about yields. A second source of possible error is in the distribution of roughage between different classes of animals, and a third in estimating the nutrient content of the various kinds of roughage. The nutrient content of hay varies considerably from farm to farm and from year to year. Hence it is perhaps dangerous to attach very much significance to any change in the rate of roughage feeding.

The increase in rate of grain feeding, concerning which the information is much more reliable, was sufficient to account for more than half of the increase in production. The remainder of the increase is probably attributable to some improvement in quality of the ration and quality of the cows. Related factors were a decrease in the seasonal variation in production and a somewhat more rapid rate of replacement of cows in the herd.

In explaining the increase in number of cows it is necessary to consider the changes in crop acreages (table 2) and the changes in numbers of the various classes of livestock (table 3). The most important

changes in crop acreage were a decrease of 144 acres in hay and small grains, most of which are cut for hay, and an increase of 147 acres in corn and millet. Thus the total acreage in feed crops was practically unchanged. The substitution of silage corn and millet for hay probably increased the feed production slightly and represented some improvement in the quality of the ration through the addition of succulent feed. It also suggests a slight tendency to reduce the length of the rotation and in this way possibly to improve the yield and quality of the hay. But as the shift involved only about 3 percent of the acreage devoted to feed crops its importance may easily be overemphasized.

TABLE 2.—*Acreage of various crops on 120 identical Cabot-Marshfield farms studied, 1926 and 1936* [1]

Crop	1926	1936	Crop	1926	1936
	Acres	*Acres*		*Acres*	*Acres*
Grass, clover, and alfalfa	4,880	4,778	Potatoes	108	96
Small grains (used for hay or grain)	489	447	Other	25	31
Corn for silage	150	221	Idle crop land and uncut hay	52	29
Other corn	21	69	Total	5,750	5,724
Millet	25	53			

[1] Acreage for the preceding crop year, 1935.

Total expenditures for lime and fertilizer on the 79 identical farms for which these data are available were $2,571 in 1926 and $2,204 in 1936. However, prices were considerably lower in the latter year. The Vermont Agricultural Experiment Station has computed an annual average price per pound of plant food in fertilizers used by Vermont farmers (*20, p. 19*). In 1926 this price was 13.4 cents and in 1935, the year covered by the 1936 data, it was 8.1 cents. On the basis of these prices the quantities of plant food purchased would be about 19,000 pounds in 1926 and 27,000 pounds in 1936. This comparison is only approximate, but there probably was a substantial increase which would tend to improve the quantity and quality of the feed produced. It should be noted that the greater (1.44 tons compared with 1.36) yield of mixed grass, clover, and alfalfa hay [10] in 1936 more than offset the effects of smaller acreage. The total hay crop was larger by 214 tons. The purchase of hay was 212 tons less (315 and 103). Silage production was 1,541 tons in 1926 and 2,325 tons in 1936.

Let us next look at the livestock changes. An examination of the data in table 3 indicates a 2-percent increase in total animal units on the 120 identical farms. Omitting hens and hogs, there was a 4-percent increase in roughage-using animal units. Horses decreased by 70 animal units, sheep and lambs increased by 8, and cattle increased by 140 animal units. Cows increased by 93 and other cattle by 47 animal units. The proportion of cows to other cattle was not significantly changed.

[10] It is impracticable to separate the acreage of the different types of hay for alfalfa and clover are usually found in mixtures with various other grasses. Farmers are likely to call a stand alfalfa or clover even though it is made up chiefly of grasses. The hay produced in the area is predominantly grass hay made up of a number of grasses—some are seeded and others come into the stand naturally as it grows older.

TABLE 3.—*Number of livestock on 120 identical Cabot-Marshfield farms in 1926 and 1936*

Class	1926	1936	Class	1926	1936
	Number	*Number*		*Number*	*Number*
Cows	1,677	1,770	Hogs	541	204
Heifers, 2 years old	250	344	Sheep	184	208
Heifers, yearlings	423	394	Lambs	42	148
Calves	532	428	Horses	356	286
Bulls	84	110			
Steers	5	2	Total animal units [1]	2,742	2,803
Hens	6,736	11,567	Total roughage units [2]	2,567	2,646

[1] 1 animal unit equals either of the following: 1 cow, bull, or steer; 1 horse; 1⅓ 2-year-old heifers; 2½ yearling heifers; 5 calves; 100 hens; 5 hogs; 10 sheep; 20 lambs.
[2] Omits hens and hogs.

Although the apparent differences in feed production are too small to have much statistical significance in view of the nature of the data from which they are derived, the consistency between the results of

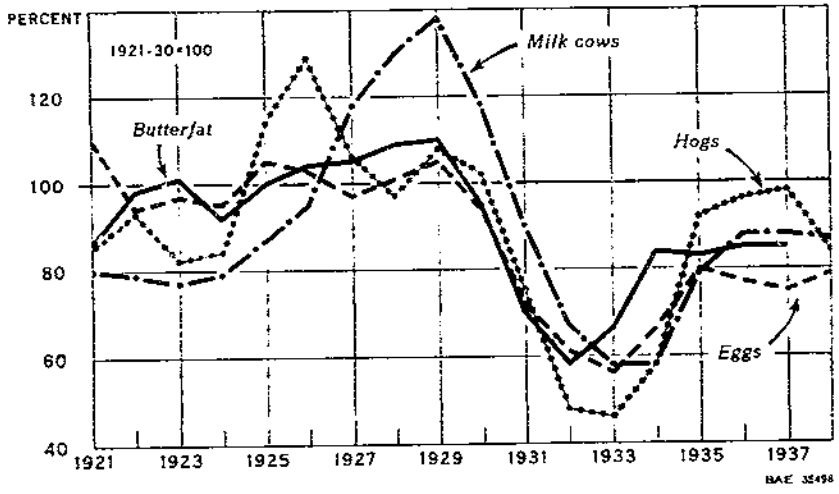

FIGURE 6.—PRICES OF PRINCIPAL FARM PRODUCTS IN VERMONT, 1921–38.

Prices of the principal farm products in Vermont all declined together during the depression beginning in 1929. Butterfat prices received by Cabot-Marshfield farmers rose somewhat earlier than did prices of other products.

the various factors measured furnishes some further evidence of their validity. There was evidently a small increase in feed production brought about by improved cropping practices. This made possible a reduction in purchases of hay as well as a slight increase in number of dairy animals kept. The decrease in the number of horses also released feed for other uses. The increased production of succulent feeds and possible improvement in the quality of hay were probably factors in the increased production per cow.

The data on receipts and expenses in tables 4 and 7 give a fairly good indication of the effect upon farm income of changes in prices and changes in farm organization. But they are not adjusted for inventory or price-level changes, and hence comparisons are subject to certain qualifications that will be indicated in the subsequent discussion. Figure 6 will serve to indicate the general character of the price changes.

TABLE 4.—*Cash receipts on 79 identical Cabot-Marshfield farms in 1926 and 1936*

Item	Cash receipts		Percentage of total	
	1926	1936	1926	1936
Milk products	$113, 158	$116, 333	48	58
Poultry and eggs	10, 715	22, 380	5	11
Hogs	12, 520	2, 626	5	1
Dairy livestock	36, 218	26, 062	15	13
Crops	19, 629	5, 565	8	3
Maple products	11, 457	6, 369	5	3
Wood and lumber	16, 514	8, 028	7	4
Outside labor	10, 521	9, 986	4	5
Other	4, 515	4, 029	3	2
Total	235, 247	202, 284	100	100
Total adjusted for difference in index of prices paid by farmers for commodities used in production [1]	161, 128	160, 543		

[1] This index is published in The Agricultural Situation, Bureau of Agricultural Economics, U. S. Department of Agriculture

Cash receipts fell off considerably although receipts from the sale of milk products actually increased by 2.8 percent over the 10-year period.[11] This increase in receipts from milk and cream sales came about despite the 16.9-percent decrease in the average price received. There was evidently a substantial increase in specialization in dairying, for the receipts from the sale of milk and cream accounted for 58 percent of total cash receipts in the later year as compared with 48 percent in the earlier one. If differences in the level of prices paid by farmers for commodities used in production are taken into account by the use of a United States index, the effects of the differences in receipts on net returns appear to be removed.

TYPE OF FARMING

The foregoing relates to all farms in the area for which expense and receipt data are available without regard to their size or type. Before proceeding further with the analysis of the income data, it may be well to give some consideration to the question of homogeneity in farm organization. The 1930 Census of Agriculture, which classified farms by type and published the results for counties but not minor civil divisions, reported 1,211 of the 2,178 farms in Washington County as dairy farms.[12] The next most important types were part-time, 370; general, 260; self-sufficing, 93; crop-specialty, 76; and forest product, 45. Dairying was probably in most cases the major farm enterprise on the part-time, general, and self-sufficing types. The situation with respect to forest products is somewhat unusual, for in this area the customary practice is to sell all of the marketable timber from a stand at one time. No further timber sales are made until another stand becomes marketable. Hence in the year of the sale this may constitute the principal source of income, and yet in other years the farm would be classified as a dairy farm. Each year there are a few such

[11] Only 79 of the 120 farms are used in this comparison because data on expenses and receipts were not obtained for the remainder.

[12] Classification is on the basis of source of income. If 40 percent or more of the income was from a given enterprise this determined the classification. If no single enterprise accounted for 40 percent of the total returns, the farm was classified as general. If more than half the products were used at home it was self-sufficing. To be classified as part-time it was necessary that the operator work outside 150 days or more, or report an occupation other than farming and that the value of farm products be not in excess of $750.

farms selling lumber, but for the most part it is a different group each year. Cordwood sales are more evenly distributed from year to year, but this does not constitute a major enterprise.

Of the 138 farms included in the 1926 study there were 11 on which the major source of income was other than dairying. On 3 of these it was sales of forest products, but in all 3 cases the dairy enterprise was second in importance in that particular year. On 2 farms outside labor was first in importance and dairying second. On 4 farms crop sales were first in importance, and on the remaining 2, poultry.

Maple products and hogs were enterprises of some importance, but in no case was either one dominant. The hog enterprise was dependent on the dairy enterprise for skim milk, and the maple-products enterprise requires attention only during a small part of the year. Hence neither makes a desirable major enterprise.

Of the 109 farms from which expense and receipt data were obtained in the 1936 survey, 11 had enterprises other than dairying as the most important source of income. On 5 of these the most important enterprise from a gross-receipts standpoint was poultry, on 4 outside labor, and on 2 forest products. Hence the situation was not greatly changed except for poultry having become somewhat more important and cash crops having disappeared as a principal enterprise.

The above is in terms of major enterprises. There were minor enterprises of commercial importance on a number of the dairy farms. Table 5 indicates the frequency of occurrence of enterprises other than dairying using an arbitrarily chosen minimum cash figure, $500, as the criterion of an enterprise. Such enterprises were more frequently found in 1926 than in 1936. Poultry and outside labor were the only minor enterprises of much importance in 1936.

TABLE 5.—*Enterprises other than dairying with cash receipts of $500 or more on Cabot-Marshfield farms in 1926 and 1936*

Item	1926		1936	
	Enterprises reported (number)	Percentage of all farms	Enterprises reported (number)	Percentage of all farms
Enterprise				
Forest products	15	11	4	4
Poultry	6	4	14	13
Hogs	7	5	1	1
Crop sales	10	7	2	2
Outside labor	12	9	10	9
Maple products	7	5	1	1
Total	57		32	
Farms reporting enterprises	39	28	28	26
Total all farms	138		109	

In studying trends in dairy production there appears to be no necessity for classifying these farms by type on the basis of combination of enterprises. There was no evident tendency for any particular enterprises to appear together. Hence no definite types emerge. The dairy-poultry farm in 1936 is the nearest approach to a combination type that is found. The larger poultry enterprises were most frequently found on the farms operated by young men or those with considerable family labor. Most such farmers were not replacing

dairying with poultry production but rather were expanding both. The poultry enterprise is frequently used to increase the size of business when there are limitations on dairy expansion.

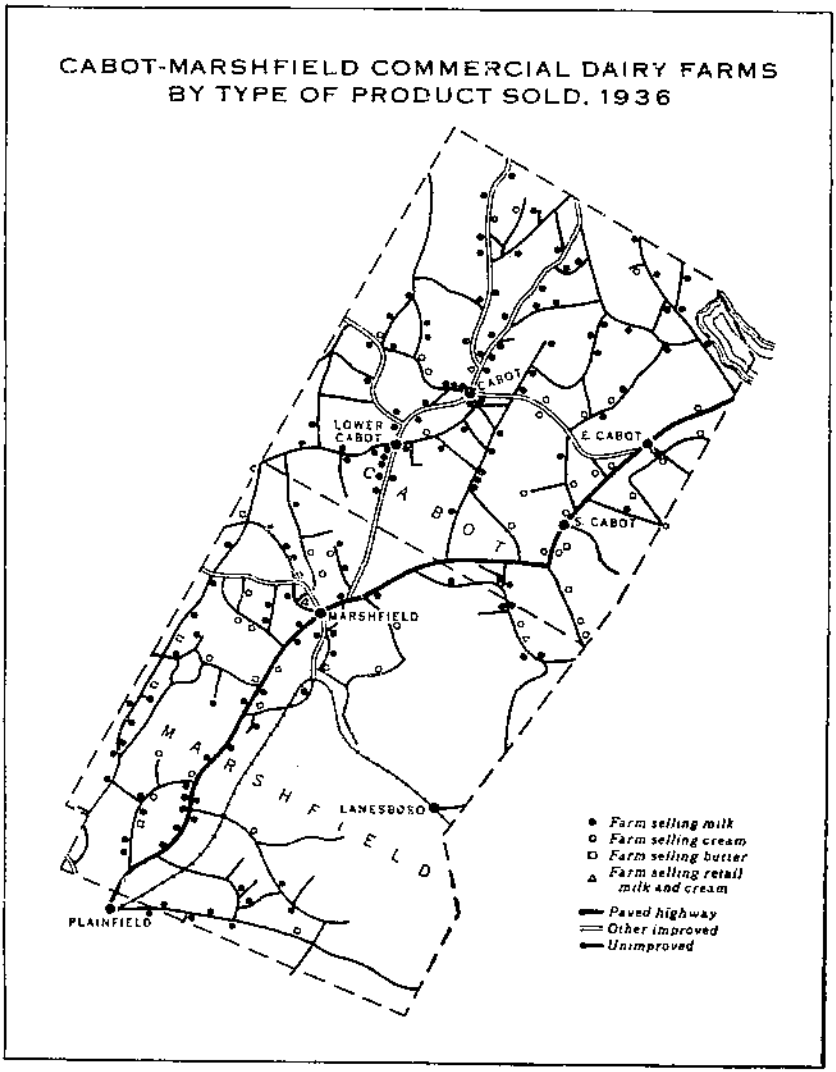

FIGURE 7.— Dairy farms are rather evenly distributed over the Cabot-Marshfield area with the exception of the rough, hilly eastern portion of Marshfield. The greatest concentration of cream farms is found in the eastern part of Cabot.

In most of the tabulations that have been made, the farms have been grouped according to number of cows in 1926, and subtotals have been calculated for the resulting size groups. Significant differences that appear between size groups will be indicated in the subsequent discussion.

Although sales of milk and cream at the receiving plants in the vicinity were of predominant importance in 1936, sales of butter made on the farm and of cream and milk at retail were also made. Some farmers shifted from one type of product to another during the year, and others sold two or more products at the same time. Classifying the farms on the basis of the form in which the major part of the product was sold, there were 140 wholesale milk farms, 46 wholesale cream farms, 7 butter farms, and 3 retail milk or milk and cream farms (fig. 7).[13]

Figure 7 indicates the location of the farmers selling their product in each form. It will be noted that 22 of the 46 who sold cream were in the eastern part of Cabot. This is to be explained by the proximity to the Danville Creamery, which receives cream and makes butter. It has always specialized in high-quality sweet-cream butter and paid a relatively high price for sweet cream.

The entire group selling cream averaged 36 cents per pound of butterfat sold as compared with 50 cents for those selling milk. The difference per hundredweight of milk would be 54 cents. Deducting 7 cents for the greater hauling cost for milk reduces this to 47 cents.

The herds on the cream farms averaged only 11.6 cows as compared with 14.5 for the milk farms. Production per cow was 4,350 pounds as compared with 5,025. Sales of milk products accounted for 49.2 percent of total cash receipts on the cream farms as compared with 61.6 percent on the milk farms. Receipts from other sources as well as from the dairy enterprise were smaller on the cream farms, despite the fact that there were more hogs and hens per farm and more heifers and calves in proportion to the number of cows. Total cash receipts per farm were $1,118, or 42.4 percent less. Cash expenses per farm, however, were $931 less, indicating that the net cash income was only $187 lower for the cream farms. It should also be recognized that the cream-farm businesses were on the average smaller than those on the milk farms. Hence the rate of return to the operator upon his investment and his labor may have been as great or possibly greater.

These comparisons again raise the question as to whether it is more profitable for farmers in this area to sell cream for butter making or whole milk for consumption as fluid milk or cream. It should be recognized that about half of the cream farmers were patrons of a creamery which furnishes an unusually good market for cream for butter making. It appears that in 1936 some farmers found it to their advantage to sell milk and others to sell cream. This depended chiefly on location, quality of cows, feeding practices, seasonal variations in production, and farm organization.

All but 1 of the 7 butter farms had fewer than 10 cows, hence they are not of much commercial significance in the area.

Farm Receipts and Expenses

With this much by way of description of different farm types we may return to the examination of the income statement for all farms in the area. The shift by most farmers from selling cream to selling milk rendered less profitable other livestock enterprises dependent on skim milk as a feed.

[13] 19 of the 215 farms sold no dairy products during this year

Figure 6 indicates that hog prices were unusually high in 1926 and that they had been considerably higher during the 5 years preceding than during a similar period prior to 1936. Thus lower prices, together with the selling of whole milk, resulted in a virtual abandonment of hog raising as a commercial enterprise.

Table 3 indicates that the size of the poultry enterprise nearly doubled, and table 4 indicates a corresponding increase in receipts. These figures, however, do not adequately describe the situation. Table 6 indicates that there were fewer small flocks mainly for family use in 1936 than in 1926, but more large flocks. During the period poultry became more of a specialized enterprise requiring considerable skill and equipment for operation on a commercial basis.

TABLE 6.-- *Distribution of 120 identical Cabot-Marshfield farms by size of poultry flock in 1926 and 1936*

Hens (number)	Farms		Hens (number)	Farms	
	1926	1936		1926	1936
	Number	*Number*		*Number*	*Number*
None	8	22	500 to 999		2
1 to 249	109	80	1,000 and over		1
250 to 499	3	6			
			Total	120	120

The large decline in crop sales is to be explained chiefly in terms of potatoes, the only important cash crop in the area. The acreage of potatoes on 120 identical farms was 108 in 1926 and 96 in 1936 (1935 crop year). However, according to the Bureau of Agricultural Economics estimates, in 1926 the average farm price of potatoes in Vermont was $1.45 per bushel, the second highest of any year since the World War, while in 1935 it was 95 cents.

Sales of maple products were only slightly more than half as much in the later year. This, however, is to be explained in part by the fact that 1936, the year of a big flood, was below average in terms of production, and in part by the lower price that year. Production for the State was reported as 1,180,000 gallons of sirup equivalent in 1926 as compared with 999,500 in 1936. The average price received was $2 per gallon in 1926 and $1.30 in 1936, according to Bureau estimates. A considerable decline in receipts from sales of wood and lumber also appears. Evidence is not available to indicate the extent to which this may be explained by lower prices, by reduction in the volume of marketable wood and timber, and by other possible factors.

Cash expenses have changed less than cash receipts. Changes in such important items as feed, fertilizer, labor, taxes, and livestock purchases were surprisingly small. There were certain offsetting factors in feed costs. More cows and hens were kept, but fewer hogs Hay purchases were much less important in the later year. Milk hauling increased considerably with the shift from cream to milk deliveries. In fact in the earlier year most farmers delivered their own product, whereas at present there are regularly established routes which handle most of the daily milk collection as well as some of the cream. The use of autos, trucks, and tractors increased con-

siderably, and hence this expense item became more important. As wage rates were somewhat lower in the later year and motortrucks, tractors, and autos were more generally used it might be expected that the expenditure for hired labor would have decreased more than was the case. Apparently these factors were offset by the use of less unpaid family labor than in the earlier period. On the 120 identical farms there were 196 children, 18 or under, and 335 adults, as compared with 175 and 299, respectively, 10 years later.

TABLE 7.—*Cash expenses on 79 identical Cabot-Marshfield farms in 1926 and 1936*

Item	1926	1936	Percentage of total	
			1926	1936
Grain	$57,133	$55,503	44.6	43.7
Hay	2,424	345	1.9	.3
Lime and fertilizer	2,571	2,204	2.0	1.7
Labor	18,426	17,561	14.4	13.5
Dairy livestock (purchases)	10,670	13,009	8.3	10.0
Other livestock (purchases)	7,843	6,255	6.1	4.8
Taxes	12,303	10,301	9.6	7.9
Milk hauling	342	2,240	.3	1.7
Auto, tractor, and truck	1,667	6,513	1.3	5.0
Other [1]	14,805	15,951	11.5	12.4
Total [1]	128,184	129,882	100.0	100.0

[1] Does not include interest payments, repairs on buildings and equipment, or expenditures on new buildings and equipment, since these items were not reported in a comparable manner in the 2 studies.

In comparing the income position of the farmers in this area in these two periods it should be kept in mind that the data presented do not take account of inventory changes, interest payments, maintenance of buildings and equipment, and wages of unpaid family labor. An examination of changes in numbers of various classes of livestock during each of the two periods indicates that there was no important change in the total during either period. The changes in buildings and equipment inventories are less easily handled, and perhaps may best be left out in comparisons of this kind, unless there has been a change in type of farming or in farm practices which substantially changes the investment in buildings and equipment required. There has been some increase in investment associated with the shift from cream to milk sales and the use of more machinery. Interest payments probably decreased slightly, but although it is difficult to secure satisfactory data regarding this item it is believed to account for a rather small portion of total expenses in this area. The family-labor force on these farms has decreased somewhat, and hence the net figure given must be considered as a return to a smaller number of workers.

The cash return to the farmer and his family on 79 identical farms after meeting cash expenses other than building and equipment upkeep and interest charges was 32 percent less in 1936 than in 1926. The Bureau's index of prices paid by farmers in the United States for commodities used in living was 24 percent lower in 1936. As the number of persons to be provided for out of this income was less in 1936 and if the United States index used is applicable to Vermont, it would appear that the per capita return on a purchasing-power basis probably remained at about the same level.

Abandonment

The process of farm abandonment in this area requires some explanation. It is usually gradual rather than abrupt. It is most frequently associated with the declining years of a farmer who has no son who wishes to succeed him on the farm. It may, however, come about following some accident such as a fire or a disease epidemic, or even as a result of a farmer moving away from the community either to resume farming operations under new circumstances or to take up nonfarm employment. Nonfarm employment may also take the place of farming with the farmhouse continuing to serve as a residence. It should be kept in mind that these factors are only one side of the picture. The other is the productive opportunity afforded by the farm in question. A well-located productive farm is more likely to survive the aging of the operator and attract a new and younger operator. Hence, as a rule, it is a combination of a relatively undesirable farm and one of the above circumstances that results in abandonment.

Abandonment appears to proceed by stages. The first is a gradual "running down" of the place through less intensive operation, associated with advancing age or outside employment of the operator. Repairs are likely to be neglected, new seeding of hay land becomes less frequent, and livestock numbers are reduced. Hay yields and quality decline and pastures grow up to brush, thus reducing their carrying capacity. The hay may not all be fed on the farm, a part of it being frequently sold standing.

The next phase is when the operator no longer keeps livestock on the farm. He may either move away or use the place only as a residence. Unless the farm is very poor and in an isolated place, some nearby farmer is likely to rent it in order to cut the best of the hay and use the remainder of it as pasture. In some cases a farmer who is expanding his business may actually keep up or even improve the condition of a farm taken over in this way, but more frequently he does not do so, and the running-out process continues with cropland becoming pasture and pasture becoming woodland.

The time required to pass through these two phases is extremely variable, depending chiefly on the rate of decrease in intensity of operation.

From the foregoing it may be seen that abandonment and the combination of farming units associated with an increase in size of farms may be quite inseparable. Of the 138 farms in the Cabot-Marshfield area from which records were obtained in 1926, 15 were either abandoned or operated as parts of other farms in 1936. However, the 120 farms, for which records are available at the beginning and end of the 10-year period, increased their total acreage by less than 1 percent despite the fact that the 15 farms that were abandoned or combined during the period were in 1936 in part operated in connection with these 120 farms. This suggests that farmers in the area may have been depending on renting some land in process of abandonment as a normal thing over a considerable period, but that they do not keep the same land, but rather that which happens to be passing through a transitional stage at that particular time. Hence a certain amount of abandonment has been a characteristic feature of the economy of the area during this period as well as over a con-

siderable portion of the past 50 years. Unless some new factor is operative a similar rate of abandonment may be expected during the next 10 years if similar price relationships prevail.

Seven, or 47 percent, of the 15 farmers whose farms were abandoned or combined also were 58 years of age or over in 1926, while only 27 percent of all of the farmers were in this age group. Hence, advancing age was definitely a factor in this abandonment. Ten, or 67 percent, of the 15 farms had 10 cows or less, although only 40 percent of all farms had 10 cows or less. Hence those farms that were abandoned or combined had smaller-than-average dairy businesses. There appears to be no significant geographical grouping of these farms, although 10 of the 15 were on unimproved roads. The production of 27,558 pounds of butterfat on these 15 farms in 1926 might be compared with the 35,486 pounds increase in 1936 over 1926 on the 120 farms referred to above. However, the 15 farms had 148 cows, while the increase for the 120 was only 93. The 15 farms had 508 acres of crops (including hay), while the 120 increased by only 64 acres. It was only by increased production per cow and more cows per acre of cropland that the farms continuing in operation were able to increase production enough to more than offset the effects of abandonment.

It is probable that if the coverage in 1926 had been complete, a higher rate of abandonment would have been found. The farms not included in that study included a large proportion of small farms and farms with some irregularity in their operation in that particular year. It is among such farms that the rate of abandonment may be expected to be highest. The number of cows affected is relatively small, however, and hence only a small adjustment may be needed in the estimate of the effect of abandonment upon total production for the area.

Age of Operators and Stability of Tenure

It is characteristic of the older farming areas of the Northeast that the farm operators, on the average, are older than those of the more recently developed areas. This is clearly shown in figure 8, which presents the age distribution of farm operators in Vermont, Minnesota, and the Northern States.[14] Settlers in a newly developed area are likely to be relatively young men. Hence a considerable period must elapse after the number of farms ceases to increase before what might be considered a normal age distribution is found. If the number of farms is decreasing the younger men are more likely to be the ones to leave the area. Vermont illustrates the situation in which the number of farms has been decreasing for some time.

The significance of this age situation is that in an area like Vermont a larger proportion of the farm operators may be expected to retire each year than in an area where the operators as a group are younger. The transfer of operation from one generation to the next is thus relatively important. The transfer may be from father to son with no abrupt change in farm organization, or it may be from a retiring operator to an unrelated purchaser. In the latter case production

[14] New England, Middle Atlantic, East North Central, and West North Central divisions as used by the Census of Agriculture.

may go on uninterruptedly or there may be some break in operations. Tenancy plays a relatively minor part in this process, only 11 percent of the farms in Vermont and 9 percent of those in Washington County being reported as operated by tenants in 1935 (*19*).

Table 8 indicates the survival rate of farm operators of different ages in the Cabot-Marshfield area from 1926 to 1936. Advancing age does not begin to show its effects until the groups 53 years old or over in 1926 are reached. For the younger groups about three-fourths continued as farm operators in the area and the remainder presumably sought farming opportunities or other employment elsewhere. As age

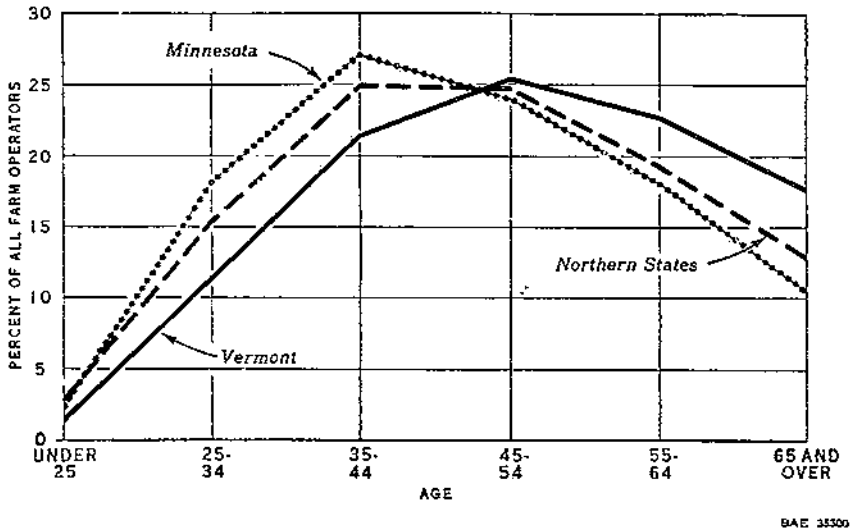

FIGURE 8.—RELATIVE AGE DISTRIBUTION OF FARM OPERATORS IN VERMONT, MINNESOTA, AND THE NORTHERN STATES, 1930.

In Vermont more of the farm operators are in the older age groups than in a more recently settled State such as Minnesota. The Northern States as a whole are intermediate between Vermont and Minnesota in this respect.

increases beyond the 53-year point the number continuing for 10 years falls off sharply. This is undoubtedly chiefly a question of death or physical disability.

TABLE 8.—*Relationship of age of operator to continuance as an operator in the Cabot Marshfield area for a 10-year period*

Age of operator in 1926 (years)	Operators in 1926	Continuing as farm operators, 1936		Age of operator in 1926 (years)	Operators in 1926	Continuing as farm operators, 1936	
		Total	Percentage of 1926			Total	Percentage of 1926
	Number	*Number*			*Number*	*Number*	
23 to 32	12	9	75	63 to 72	19	9	47
33 to 42	29	22	76	73 and over	5	0	0
43 to 52	37	29	78				
53 to 62	33	18	55	Total	135	87	64

From the standpoint of production trends, it is change in age distribution over time that is important. There were minor differences in the age distribution of farm operators in the Cabot-Marshfield area in 1926 and 1936 with a slight tendency toward greater concentration in the upper-age groups in the latter year. In 1936, 61 percent of the farm operators reporting their ages were 48 years of age or older as compared with 57 percent in 1926. That this was not the result of the omission of small farms in 1926 is indicated by the comparison for identical farms which shows an even larger percentage of older farmers in 1936. Apparently the average age was still increasing slightly.

The relationship of age of operator to size of business as measured by number of cows is shown in table 9. Evidently there is a tendency for young farmers to increase the size of their dairy herds until they are well past middle age, and then to decrease again during their declining years. The farm business in this area is in most cases rather closely related to the family-labor supply. Hence during the period when the sons are growing up, labor is available for some expansion. When the sons have grown up and gone away, and the physical ability of the operator has begun to decrease, the dairy herd is cut down. The exceptions are explained by operating with hired labor or by mature sons who remain on the farm. Available capital may also be a limiting factor in the case of young operators. Of the 120 farms for which comparable data are available in 1926 and 1936, 81 were operated by the same person during the latter year, 9 were operated by a son, and 30 were operated by someone not related to the original operator. The average ages of the operators on these 3 groups of farms in 1926 were 47, 65, and 49, respectively. One would expect the group replaced by their sons to be older than the other two.

TABLE 9.—*Relationship of age of operator to number of cows in herd on 205 Cabot-Marshfield farms in 1936* [1]

Age of operator (years)	Cases studied	Cows, average per farm	Age of operator (years)	Cases studied	Cows, average per farm
	Number	*Number*		*Number*	*Number*
Under 35	23	11.4	65 to 74	26	10.8
35 to 44	45	13.4	75 and over	7	8.2
45 to 54	47	15.6			
55 to 64	57	11.9	Total	205	12.8

[1] 9 records on which there were no cows in 1936 and 1 additional record on which the operator's age was not given were omitted from this table.

Now let us look at the effects of these tenure changes on volume of output. The group with the same operators throughout, increased milk production by 11 percent, the sons increased it by 14 percent, and the remaining group by 12 percent. The differences are slight, although it seems in accordance with logical expectation that the sons should have been the most successful in increasing production. Apparently changes in farm operator do not disrupt production for very long. The increasing average age of all operators then is probably important in its effect on total production of milk in the area chiefly through the direct effect of age upon size of herds kept. The effect of an increased rate of turn-over in operators is of minor importance.

Racial Characteristics of the Farm Population

The population of the Cabot-Marshfield area is predominantly native white. In 1930 only 7 percent were foreign-born and 14 percent were native-born with foreign or mixed parentage. These 2 groups are composed mainly of French-Canadians. Although the census does not report nationality on a minor civil division or even a county basis with a farm and nonfarm break-down, for the State as a whole 56 percent of the foreign-born rural farm population was French-Canadian. Of the native-white rural farm population with foreign or mixed parentage, 43 percent was French-Canadian. Between 1920 and 1930 the number of foreign-born French-Canadians in Washington County increased from 832 to 2,067 (*17*). In the 1926 Cabot-Marshfield survey 8 of the 138 farmers included were French-Canadian or of French-Canadian descent. There were 28 among the 222 farmers included in the 1936 and 1937 surveys. This is the only immigrant-population group in the area and, although it is now comparatively small, it increased considerably during the decade under consideration.

Perhaps the most conspicuous characteristic of this population group is its relatively high birth rate. The median size of family among the native-white rural farm population of native parentage in Vermont in 1930 was 3.43. For the foreign-born white group it was 4.36, while the native-born with foreign or mixed parentage group was intermediate with 3.60. This latter figure is nearer that for the native whites of native parentage, suggesting perhaps that the difference is not very persistent after immigration.

From the data in table 10 it may be observed that the French-Canadian farmers on the average had more cows and more acres of cropland than other farmers. The crop acreage per cow was only slightly greater. Production per cow was slightly lower for the French-Canadians. The larger size of business on these farms is associated with a larger supply of family labor. This may be explained by the higher birth rate and the lower average age of farm operators. It appears, therefore, that land resources were being used at about the same labor intensity by both groups. Probably the most significant consideration is that the entrance of French-Canadians may keep some farms and parts of farms in operation that might otherwise be abandoned. There has been some slowing down in the rate of farm abandonment, but the extent to which it may be explained by the influx of French-Canadians is uncertain.

Table 10.—*Comparison of farms operated by French-Canadians and by all others in Cabot-Marshfield area, 1936*

Operator	Farms	Cows per farm	Milk production per cow	Cropland	
				Per farm	Per cow
	Number	*Number*	*Pounds*	*Acres*	*Acres*
French-Canadian	[1] 28	14.4	4,732	56	3.9
All other	[2] 187	12.0	4,853	43	3.6

[1] Includes 2 farms on which there were no cows in 1936.
[2] Includes 7 farms on which there were no cows in 1936.

Summary of Changes Since 1926

Milk production in the Cabot-Marshfield area apparently increased about 6 percent between 1926 and 1936. For the 120 identical farms for which records were available for comparison the increase was 11.5 percent. This was brought about by an increase of 5.5 percent in cow numbers and 5.6 percent in production per cow. This appears to be representative of the changes occurring in the area for those farms continuing in operation. But as there has been some farm abandonment, with accompanying reduction in cow numbers, this must be placed against the gains on the continuing farms to get the net area change. The 15 farms abandoned were responsible for about 8 percent of the production on the farms studied in 1926. Allowing for this offsetting factor still leaves the increase in production for the area to be 6.3 percent.

The increase in number of cows per farm was made possible in part by the release of feed formerly used by horses replaced by motor-trucks and tractors. There was some increase in feed production brought about by a moderate increase in the use of lime and fertilizer and a larger proportion of the total acreage in annual crops. This greater quantity of available feed also made possible the elimination of about two-thirds of the hay purchases. Furthermore, the quality of the roughage ration fed to cows probably was improved as a result of a larger proportion of millet and silage, and some increase in the nutrient content of the hay. This, together with an increase of about 100 pounds per cow in the rate of grain feeding, is sufficient to account for most of the increase in production. Some improvement in quality of cows and more rapid replacement may also have contributed in this direction.

In 1926 the farmers in this area sold cream to be used in butter making. The milk was separated on the farm and the skim milk used as a feed for calves and hogs. In 1936 more than 80 percent of the deliveries were in the form of whole milk. As a result, hog production, as well as the fattening of veal calves, had been given up by most farmers.

Poultry raising approximately doubled in importance as many small family flocks disappeared and were replaced by a relatively smaller number of larger commercial enterprises. Despite this, however, the proportion of the total cash receipts from the dairy enterprise increased from 48 to 58. The balance of receipts over expenses was smaller in 1936, but if the lower price level and the smaller number of family workers were taken into consideration most of this difference would disappear.

PROSPECTIVE TRENDS IN PRODUCTION

The main purpose in describing recent trends in dairy production is to develop a basis for the consideration of the factors that may be expected to affect production during the next few years. It is against a background of past experience that farmers judge the future and formulate their plans. With a knowledge of how individuals and groups of farmers have reacted one may predict with more assurance how they will react to situations in the future.

Certain trends which were observed can be fairly safely projected into the future without much consideration of developments outside of this area. An example is a certain amount of improvement in cropping practices which seems likely to continue even with less favorable prices. There are many other trends, however, the courses of which are dependent upon external developments. Perhaps the most important of these are price relationships. Reliable forecasts cannot be made of prices with data relative to one producing area, or even with data on all producing areas, without some knowledge of the long-time-demand situation. Until such knowledge exists a first approach may well be a consideration of the probable trend of production under each of three possible price situations: With a continuance of present price relationships, with somewhat more favorable milk prices, and with correspondingly less favorable milk prices. This will furnish something in the nature of a tentative supply schedule for the area.

During the 10 years preceding 1936 milk prices fluctuated as much as 35 percent from the average for the period. However, the high and low points reached were not maintained long enough for anything more than short-time adjustments to be made. The number of cows in the area has not been adjusted to either the highest or the lowest prices reached. Furthermore, in terms of relationships between prices of dairy products and other commodities the magnitude of fluctuations has been much less. The interest here is basically in the levels of prices prevailing for a long-enough time for such adjustments to be made. Levels of milk prices 15 percent above and 15 percent below that of 1936 have been chosen as including an appropriate range for analytical purposes. These price levels are considered as relative to present prices of other farm products of the area and to cost factors. They are considered as of sufficient stability for adjustments in number of cows, and cropping and feeding practices to be made. A 10-year period is taken as of appropriate length for such adjustments.

Analytical Procedure

The analytical device frequently used in farm-management work, and referred to as the budget method, seems to lend itself very well to use in dealing with this problem. This technique is commonly used in discovering typical farm organizations which in the light of the best available evidence relative to prospective prices may be expected to produce maximum farm incomes. Several alternative organizations of the farm business are tested out in terms of net income under the price conditions expected and with normal growing conditions.

In using the budget method to estimate farmers' response to prices it must be recognized that farmers sometimes, perhaps usually, do not actually adopt the most profitable course of action. When a price change occurs there is a tendency to adjust the farm business in the direction made most profitable under the new conditions, but there are many obstacles to change not only in the form of fixed investments which require time for liquidation but also inertia, lack of information, and individual likes and dislikes which outweigh monetary gains. The problem of fixed investments can be handled on an ob-

jective basis by the budget method by a careful consideration of time periods. Inertia and lack of information are more subjective and hence more difficult of treatment. We may estimate for a group of farmers the extent of lag in adjustment to the most profitable organization of resources on the basis of past experience or, if acquainted with their individual characteristics, we may make a separate estimate for each and combine these estimates to arrive at a group estimate. Both these approaches were used in the present study. Much of what has been said about inertia and lack of information applies also to individual likes and dislikes, but the individual-estimate approach seems definitely more applicable here.

In practice one is likely to discover that "most profitable," if treated on a strictly objective basis, is quite unrealistic. Many extension workers have discovered this to their regret when they have proposed plans that call for more or different types of work for the farmer or members of his family or even for hired men. The human productive resource involved is not a standard article that can be juggled about mechanically in a highest profit analysis.

In general, the procedure followed in this study is to consider first a most profitable farm organization for each price situation in as realistic terms as possible and then on the basis of personal acquaintance with the farmer and his past record of performance to estimate the effect of subjective factors in causing him to fall short of the point arrived at in the first approximation. Certain group adjustments are necessary in the totals thus arrived at for individual farms.

Logically, the farm-budget method of estimating is merely a systematic procedure for analyzing all of the elements entering the problem on each selected farm, then carefully weighing their importance and arriving at judgments in the light of the known facts. The whole procedure brings together in condensed summaries the probable systems of crop and livestock production and the estimated receipts and expenses. An essential part of the procedure is a systematic comparison of partial and complete alternative arrangements of the fixed and variable resources available to the farm operator.

As with any method of estimating future events, the results can be only as good as the basic information and knowledge and the amount of careful thinking and analysis that goes into its interpretation. The critics of budgeting frequently point to the large element of judgment, which accompanies the application of budgeting procedure, as its chief weakness. The real truth is that the peculiar advantage of the budget method lies in the opportunity it offers to eliminate a considerable part of the judgment which, without exception, is found in any research procedure involving estimates of the future. Proper budgeting should separate the known and unknown factors in the problem and bring the judgment process to bear more definitely on the unknown factors alone. The chances for good judgments are thus improved.

The data available for use in this budget analysis include several types of records. In 1936 rather complete farm-business records, including all receipts and expenditures, were obtained from 109 farmers. These farmers were selected so as to include the farms covered in the 1926 study insofar as possible. They were also selected to include a sample of each number-of-cows size group and to represent farms selling both cream and milk. Other factors considered were location (whether valley or hill) and age of operator. An attempt was made

to sample each subclassification on the basis of those factors most likely to be significantly related to production response. A shorter record containing basic production data, but not a complete income statement, was obtained from each of the remaining farms engaged in commercial dairy production in the area. This provided an opportunity for testing out various sampling procedures from the standpoint of representativeness of the area as a whole. A brief record was obtained from each farmer in the area in 1937 and again in 1938 in order to follow up the actual changes taking place. But this analysis was started on the basis of the 1936 data, and the conclusions are mainly based on them.

Normalizing Single-Year Data

In budget analysis it has been found most satisfactory to use average or normal yields for a period of years, average or normal expectancy of disease loss, and the like. Any particular year may depart from such a normal, but still this normal is the most likely in the statistical-probability sense and hence the best basis upon which to construct future plans. To compare various budget plans with the plan actually being followed it is necessary to make the comparison on the basis of normal conditions with respect to such items as those mentioned. The business during the year for which records were taken may, for example, appear out of balance or adjustment simply because it was an unusually dry year and crop yields were correspondingly low. Therefore the first step is to correct or adjust the records for such abnormalities as happened to occur during that particular year.

The selection of the data that should be used in normalizing is rather difficult. One approach is to ask the farmer such questions as what his normal yields are or what he considers to be his normal expenditure on upkeep of various items of durable equipment. It is difficult for farmers to form a judgment relative to such questions. The most recent years or the best recent years may carry undue weight in the case of yields, and some recent large expenditure may distort the estimate of normal upkeep costs.

In the case of yields of crops that are regularly reported by the Federal-State Crop and Livestock Estimating Service it is possible to determine the average for a period of years, compare the year of record with this average, and adjust each individual record proportionately. Some allowance may be necessary for the fact that the weather during a given year may be favorable to yields on some soil types or slopes and unfavorable on others. The yield of tame hay in Vermont from 1930 to 1937 averaged 1.17 tons per acre. In 1935, the crop year covered by the 1936 records, the average yield was reported as 1.21 tons per acre. The difference is so slight that an adjustment was not considered necessary except in those cases where the farm operator indicated a definite abnormality in his hay yields. Hay is the most important feed crop in the area, and other feed crops and even pasture, to a considerable extent, are affected in the same way by climatic conditions. Hence only occasional individual farm adjustments appeared necessary in normalizing yields.

Expenditures on upkeep and maintenance of buildings and equipment were handled by making tabulations for the whole area showing the relationship between expenditures and total value or investment,

intensity of use, type of machine, and other factors. The average relationships thus arrived at were used as a basis for normalizing expenditures for each farm, making judgments where necessary to take care of unusual situations.

A number of factors such as frequency of replacing dairy cows, proportions between different classes of young stock and cows, and prices received for old and young cows sold, were handled in much the same way as were expenditures on the fixed plant.

The relationship between prices of different products as well as that between prices and various cost rates is of major importance. Adjustments are necessary in the case of those prices that were abnormal in the year in question. However, the determination of normal prices is more difficult than the determination of normal yields and normal overhead expenses. Some consideration has already been given to this question in the preceding section on past trends.

By referring to figure 6 it may be seen that prices received by Cabot-Marshfield farmers for dairy products were higher relative to prices received for eggs and milk cows during most of the period from 1933 to 1937 than during the 1920's. The same is true with respect to chickens, veal calves, and potatoes. Prices for hogs are an important exception, but it has been shown that hog production was dependent on the skim milk that was available when cream was being sold. When all feed must be purchased the hog enterprise does not appear to be profitable in this area. The price comparison between dairy products and other products is subject to further qualification as a result of the shift from cream to milk deliveries. If the prices received for dairy products during this later period could be corrected for additional labor, hauling costs, and investment charges connected with fluid-milk deliveries, most of the difference would disappear. Taking this into account, it would seem that the 1936 price indexes are near enough together so that no adjustment in prices is necessary in normalizing.

These are the more important items affected by the normalizing process. Other minor items were handled in the same general way. By this means a statement was developed for each farm business showing numbers of different classes of livestock, yields, and feeding rates as well as total production, and expenses and receipts as they might have been had 1936 been a normal year climatically and had the business of each farmer been normal in every respect.

Trends Under Way in Relation to Present Price Relationships

The description of changes during the period 1926-36 has amply demonstrated that changes are likely to occur in the productive organization of every farm in an area during any period of this length. Many of these changes are in response to changes in prices, others are in response to weather conditions, biological factors, and the like, and still others occur without respect to these stimuli. Price changes are likely to affect all farmers in the area. Epidemics of disease may be general or selective. Weather conditions are usually general. The effects of weather in any given area are likely to average out over a period of years; that is, they do not change persistently in any one direction so as to give rise to long-time trends in production.

We are most interested at this point in trends that are general for the area, that are not related necessarily to price changes, and that operate persistently in one direction over a period of at least 5 to 10 years. Three important trends of this type were described in the preceding pages. They were an increase in number of cows per farm, an increase in production per cow, and a decrease in number of farms as a result of abandonment. The net result of these trends was an increase in total milk production for the area. It might be said that these are long-time adjustments to past changes in price relationships and other factors which go on so slowly that several decades are required for their completion. Hence we are interested in a net rate of area change by decades. Centering our attention on these changes we omit for the moment the changes that an individual farmer makes as he grows older and those that he makes on a temporary basis because of the unusual growing conditions in a particular year.

Selling milk rather than cream was stimulated, as has been noted, by the opening up of a market for milk at prices that appeared to be somewhat above those paid for cream. Apparently the main effects have been realized since the net change during the last few years has been slight. The possibility of a change, however, needs to be evaluated on each farm, especially as our analysis suggests that at present, on many farms, selling cream and selling milk are about equally profitable or at least the advantage one way or the other is slight.

The increase in production per cow since 1926 was found to be mainly the result of feeding a somewhat better ration. The better ration resulted from feeding more purchased grain, and this may have been due in part at least to an apparently more favorable relationship between milk and grain prices. Is this change complete with respect to existing prices? Perhaps so, since this is the type of adjustment that can be made rather quickly. There may, however, be further effects in the form of changes in cropping practices.

Another possibility for improving the ration lies in growing more and better roughage. This possibility has been brought out by a new factor in the situation, the agricultural conservation program, rather than by trends prior to 1936. The practices now being encouraged by Federal conservation payments are increasing both the yield and quality of hay produced, with similar effects on silage, millet, and small-grain hay. To some extent the continuance of these practices depends on the continuance of payments, but there is reason to believe that in many cases the practices are proving sufficiently profitable to insure their continuance without payments. Therefore, this is certain to be a significant factor during the next 10 years.

In view of this situation an agronomist and a farm-management worker made a joint personal inspection of a sample group of 26 farms in Cabot and Marshfield to evaluate the soil-improvement possibilities. For each soil type and slope on each farm an estimate was made as to the fertilizer treatment best adapted and the results that might be expected from its application. The resulting data furnished the basis for working out individual farm-cropping plans that it was estimated the operator would be likely to carry out even though conservation payments under the present conservation program should not be continued.

The next question that arises relates to the effect of the additional roughage of improved quality on feeding practices and milk production. This question is so related to the price of milk and price of grain that it cannot be treated independently. It must be worked out on the basis of a comparison of returns from alternative procedures. To do this, however, we must draw upon the best available data relative to rates of feeding dairy cows and milk production.

In recent years some doubt has arisen relative to the general applicability of previously accepted feeding standards. An important piece of research upon this problem is now being conducted by the United States Department of Agriculture.[15] Final results are not yet available but tentative conclusions have served to guide this part of the analysis.

The Morrison feeding standards (*12, p. 1004*) recommend for good cows under usual conditions 0.324 pound of total digestible nutrients per pound of 4-percent milk produced in addition to the requirements for maintenance of the animal. This is intended to tell a farmer how much he should feed a cow when she is producing a given quantity of milk. It does not tell him how much he can increase production by increasing feed. It has frequently been implied, however, that for each increase of 0.324 pound of total digestible nutrients fed, milk production will be increased by 1 pound up to the limit of the cow's capacity, after which there will be no further increase in production. It has long been suspected that beyond a certain point there is a gradually decreasing rate of increase in production with increased feeding rather than an abrupt limit. The studies referred to above bear out this hypothesis. Our problem is to apply these findings in estimating the rate of response to increased or decreased feeding and from this the most profitable rate of feeding.

The Jensen studies[16] show that cows differ in their productive capacity, and that as capacity increases the response to a given increment of feed increases. As any given cow approaches the maximum production of which she is capable, however, the increase per unit of feed decreases. We need then to take into account both the capacity of the cow and the rate of feeding and production relative to capacity. It is, of course, desirable to simplify our procedure as much as possible when dealing with large numbers of dairy herds.[17]

In order to apply the experimental results it is necessary to measure the productive capacity of the cows with which we are working. In the absence of a better measure we have used present production. While not dependable for any given herd of cows, the herds that are underfed may be balanced by those that are overfed so that approximately the correct result is secured for the group as a whole. On this basis we would estimate a greater response to a given increase in feed for a herd producing 6,000 pounds of milk per cow then for one producing 5,000 pounds because we would expect the cows in the former herd to be better.

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[15] Under the direction of Einar Jensen, Bureau of Agricultural Economics, jointly with Bureau of Dairy Industry. Cooperative input-output studies are being carried on with 10 State agricultural experiment stations. See the following: JENSEN, EINAR. SOME RESULTS OF THE UNITED STATES DEPARTMENT OF AGRICULTURE EXPERIMENTS IN DAIRY FEEDING. New England Res. Council on Marketing and Food Supply Proc. Ann. Mtg. April 26–27, 1939, pp. 34–43, illus. [Mimeographed.]

[16] See footnote 15.

[17] Our data are all in the form of herd averages. We must assume that production responses for the herd are the same as though each cow were the same as the average.

The above refers to differences in marginal output between different cows. We must also deal with differences in marginal output at different rates of feeding for the same cows. The experimental studies indicate that the rate of decrease in marginal outputs of milk within the usual range of feeding is small. This would suggest that considerable changes in rates of feeding would be profitable with changing prices. However, when all of the elements in the situation are reviewed, the estimate for the change in the rate of feeding seldom exceeds 15 percent under the conditions set up in this study. With changes of this magnitude it appears that diminishing marginal outputs may be ignored without serious loss of accuracy.

A rather simple rule for estimating the effects of different rates of feeding seems to give reasonably satisfactory results. This rule is that a given percentage increase in total digestible nutrients in the entire ration (maintenance and production) will result in the same percentage increase in milk production. This allows for differences in capacity in a manner which may perhaps best be explained by an example. A cow producing 5,000 pounds of 4-percent milk might normally be fed 5,000 pounds of total digestible nutrients. According to the above rule a 50-pound (1 percent) increase in feed would result in a 50-pound (1 percent) increase in production. On the other hand, a cow producing 6,000 pounds of milk might normally be fed 5,500 pounds of total digestible nutrients. Here a 55-pound (1 percent) increase in feed would be estimated to result in a 60-pound (1 percent) increase in production. This increase in output of milk per additional unit of feed is approximately the same as that found in the Jensen studies. It does not allow for diminishing marginal returns from increased rates of feeding the same cows, but for the reasons given above this appears not to be necessary in this analysis.

One further point with respect to the estimation of changes in feeding on production should be noted. This has to do with variations in the proportion of roughage and concentrates in the ration. Ordinarily it would not be safe to assume that additional roughage could be utilized so effectively as concentrates or even so well as the roughage already consumed. But under the expected conditions in the Cabot-Marshfield area, there is anticipated some improvement in quality of not only the increase but of the entire roughage portion of the ration. Care has been taken in every case to keep total roughage feeding within reasonable limits with respect to total quantity and proportion of the entire ration. With these precautions it has not been considered necessary to make further allowance for changes in the proportion of roughage and concentrate feeding. Within these limits total digestible nutrients from concentrates and from improved roughage have been treated as equivalent.

The preceding discussion deals with the method of handling the increased feed available as it affects rates of feeding and production. Additional roughage may be used to increase total feed as a substitute for a part of the grain ration, or some combination of both. When more feed is available than can be used in this way, some increase in number of cows is probable when no limitations in barn space or available labor stand in the way.

The effect of increasing roughage production on number of cows has already been mentioned. A shift from horse to mechanical power was noted as a factor in this situation during the decade studied.

This released feed which made possible some increase in number of cows. May a continuation of this trend be expected? The use of tractors and trucks on farms in this area may be said to have begun since 1926. As tractors have been improved, and as horses have grown old, farmers have tended not to replace the horses and practically all replacements made in this area are purchased. The price of horses has been higher during the last 3 years than at any time since 1920. Hence it would appear that conditions have been continuously becoming more favorable to the use of tractors and that since such adjustments come about slowly the trend away from horses may be expected to continue for some time to come.

A similar situation is found in the case of motortrucks. The extension of improved roads and the improvement of trucks have resulted in the displacement of horses in hauling products to market and supplies to the farm. Furthermore, considerable hauling on the farm itself may be done with motortrucks. The family automobile has virtually displaced the horse and carriage in making trips to town. Hence the use of horses has been reduced in several ways. Instead of a pair of horses to do the heavy work and a lighter horse to do numerous lighter jobs, the situation is becoming one of using only the pair of horses, and some of their work has been taken over by tractors.

Farm abandonment is another factor to be dealt with. Between 1880 and 1935 the number of farms in Washington County as reported by the United States Census of Agriculture decreased from 3,229 to 2,143, or 33.6 percent. Land in farms decreased 23.7 percent over the same period. The process seems to be still going on, as indicated by the abandonment of 11 percent of the farms covered by the 1926 survey during the 10 years following.

In considering the farms in the area individually there were certain ones for which the best estimate for the next 10 years was abandonment, with any of the price situations considered. These were farms operated by elderly persons with no probable successors. In addition they were farms in such poor locations or state of productivity that the likelihood of their being taken over by a new operator is slight. Twelve farms fell into this class.

But this does not adequately care for the problem of abandonment. The study of abandonment in the past suggests that unless some important change has occurred somewhat more than 12 farms will be abandoned. Although the best estimate for certain doubtful farms might be that they would be in operation 10 years hence, out of 10 such farms several might be abandoned. The actual number might be different under each of the price situations under consideration, and will be discussed further in the following pages on effects of prices.

Effects of Prices Upon Production Trends

Those trends related to the volume of milk production which may be expected with a continuance of existing price relationships have been discussed. Their rate and even their direction may be affected by changes in price relationships. In general an increase in prices of dairy products relative to prices of other products and costs may be expected to accelerate those trends associated with increased production, and the converse is equally true. The situation is differ-

ent with each type of trend, however, and hence a more detailed consideration is needed.

The number of cows would be expected to increase with higher prices and decrease with lower prices. Feed for an increased number of cows may be provided in several ways– by taking feed from other classes of stock, by growing more feed, and by purchasing more feed. It may require an addition to barn facilities or equipment or an addition to the labor supply. Any or all of these adjustments may be encouraged by higher prices. Perhaps the most important item is the production of more roughage and pasture by using more fertilizer. The higher prices not only make additional applications more profitable, but make financing them easier.

A decrease in prices of dairy products would be expected to bring forth the reverse changes, but many rigidities stand in the way of decreases in production. These, however, can best be dealt with farm by farm.

One problem has caused some special difficulties with respect to the estimates of production. If with lower prices we are to depend on the best evidence available, relative to the results of the increased use of fertilizer, we are led to the conclusion that on many farms a substantial increase would be profitable even with milk prices 15 percent lower than at present. At first thought it seems unreasonable to expect an increased rate of fertilizer application with lower prices. This would be reasonable only if farmers were to become familiar with the advantages of practices of which they are now uninformed or at least uncertain. We must recognize that these practices are not very thoroughly tested in the farm organization of the area, that the advantages of their adoption would be reduced by lower prices, and that in some cases financial or credit limitations might appear. On the other hand, this might be the most promising way of offsetting the unfavorable effects of lower prices and, as such, might be continuously stimulated by public programs.

The method of handling this point has been to estimate that such practices would not be adopted except in cases in which they have already been tried out successfully or there is other direct evidence that they would be followed. A separate plan was also worked out including crop improvement wherever it is feasible and the operator is the type to adopt it under favorable circumstances. In this way the probable effects of more general adoption of crop improvement under lower-price conditions were ascertained.

The most important factor causing variations in production per cow is rate of grain feeding. This in turn is rather sensitive to the milk-feed-price ratio. Hence higher rates of feeding are almost certain to result from higher prices and lower rates from lower prices. The provision of more and better roughage through more intensive fertilization is also related to higher prices. Attempts to get better cows may be stimulated by higher prices although for a time this may be offset by keeping poorer animals in the herd in order to increase production.

Farm abandonment is in considerable part dependent on the relative returns from dairying in this area and alternative types of employment. Hence it may be expected to increase with lower prices and decrease, cease, or even be reversed with higher prices.

There are, however, certain immediate causes of abandonment such as old age, fires, and accidents, which are not directly related to the price level.

It has been indicated previously that the average price received for dairy products was in about the same position relative to the prices of other products in 1926 and in 1936. Hence this approximated a situation with no trend in prices. Taking these factors into consideration, estimates were made of the probability of abandonment for each price situation for each farm about which some doubt existed. There were some farms for which the likelihood of abandonment and continued operation seemed to be about equal. On one side of these were the ones for which abandonment seemed more probable and on the other those for which continued operation seemed more probable. The procedure followed in each price situation was to consider as being abandoned all of those for which abandonment seemed more probable than continued operation and about half of those for which the chances were even.

As a result of this procedure an estimate was obtained of 20 farms abandoned with 1936 price relationships, 12 with higher milk prices and 30 with lower prices. On a percentage basis these figures become 9, 6, and 14, respectively. They may be compared with the 11 percent of the farms included in the 1926 study actually abandoned during the subsequent 10 years. For each of these farms a separate decision was made as to whether abandonment would be complete or whether there would be some use of the resources in connection with the operation of neighboring farms.

Another question to be considered relates to the effect of different price levels on the proportion of the product sold as fluid milk. In actual practice a change in price level may not affect the price of milk and the price of cream in just the same way. Thus one or the other may become relatively more profitable as a result of the change. The complicated analysis needed to indicate the relationship between milk and cream prices at different levels has not been undertaken. Instead it was considered that milk and cream prices would move up or down together with about the same absolute margin. On this basis it takes a 20-percent change in cream prices to be equivalent to a 15-percent change in milk prices.

This procedure does not necessarily preserve the present balance between selling cream and selling milk. Certain costs are involved in selling milk which may be eliminated in selling cream. With lower prices such savings may become more important. Hogs, calves, or chickens may be fed on the skim milk left on the farm when cream is sold, and with lower prices for milk such enterprises become relatively more profitable. For these reasons there is a tendency to shift from milk to cream as prices decline. The extent to which this tendency is offset by a 5-percent greater decline in the case of cream prices is uncertain.

There are technical reasons related to the receiving-plant facilities for not expecting much shift back to cream. One of the receiving plants, for example, is now equipped only for handling milk in railroad tank cars. Another plant has outlets for fluid-milk and cream sales and has equipment for handling these products as well as butter and skim-milk byproducts. A shift to receiving cream, therefore,

runs up against resistances related to the present plant equipment in the area which are likely to be determining during the 10-year period.

Except in a few cases where there seems to be some special reason for a shift, production was estimated on the basis of the continuance of the present practices of selling milk or cream. The volume of production is not likely to be much affected by the form in which the product is sold under the price conditions that have been described. Perhaps the most important reason for an exception to this statement is that more heifers may be raised and the number of cows correspondingly reduced if cream is sold. In general, however, interest is centered in the total volume of milk produced and sold in any form in the area. The estimates made apply to this and not to the relative quantities of milk and cream sold.

Constructing Farm Plans and Budgets

The foregoing discussion covers the basic considerations which served as a guide in working out plans for the individual farms in the area. We may now proceed to explain the mechanics of handling the individual farm data.

Starting with the normalized farm record for 1936, three farm plans or budgets have been worked out for a time about 10 years later. The first of these, called A, is in terms of present price relationships; the second, called B, is in terms of milk prices 15 percent higher relative to all other prices; and the third, called C, in terms of milk prices 15 percent lower relative to all other prices. In the case of farms selling cream or butter a 20-percent change has been substituted for a 15-percent change.

To reduce the subjective element independent estimates were made by different persons for the same farm. Reasons for differences in estimates were observed and discussed. The final estimate for each farm represents the combined judgment of two or more persons, at least one of whom has visited the farm in question.

The budgeting procedure can perhaps best be presented by going through the steps taken in working out the estimates for a particular farm. The farm selected for this purpose represents the area reasonably well and hence illustrates many of the types of decisions that must be made. In 1936 it had the general organization shown in table 11.

Table 11.—*Land, crop, and livestock organization of a sample farm*

Land:	*Acres*	Livestock:	*Number*
Crop	38	Cows	13. 5
Open pasture	46	2-year-old heifers	5. 5
Woods pastured	41	Yearling heifers	4. 5
		Calves	1. 5
Total	125	Bulls	1. 0
Crop:		Horses	2. 0
Potatoes	1	Hogs	1. 0
Millet	1	Hens	174. 0
Oat hay	4		
Mixed hay	32		
Total	38		

The hay yield per acre in 1935 was 1.22 tons. The cows were fed as follows:

	Pounds per cow
Total digestible nutrients:	
In concentrates	2,318
In dry roughage	1,751
In millet	141
Barn fed	4,210
From pasture (estimated)	1,242
In total ration	5,452
Milk production	4,977
Butterfat test—percent	4.55

The cash receipts and expenses were as follows:

RECEIPTS

3 cows	$210	100 gallons of maple sirup	$150
11 calves	16	800 dozen eggs	200
2 hogs	35	Outside labor	40
100 hens	100		
150 bushels of potatoes	248	Total	2,274
60,640 pounds of milk	1,275		

EXPENSES

Hired labor	$200	Sirup cans	$3
Building repairs	25	Dust (for potatoes)	6
Grain	1,156	Seed	13
Skim milk	2	Fertilizer	14
Bedding	10	Auto	100
Can charge	4	Telephone	12
Horse shoeing	7	Insurance	32
Whitewash	3	Taxes	103
Fly spray	2		
Salt	2	Total	1,694

The first step is normalizing the foregoing data. We may begin with numbers of livestock. The number of cows was 15 at the beginning of the year and 12 at the end. The simple average of these is 13.5, and in order to deal with whole numbers it was increased to 14 in normalizing. It was raised by a half rather than lowered, since the following year the number was increased to 17. Apparently the practice on this farm is to raise enough heifers for replacements, but in this particular year the distribution of heifers of different ages was abnormal. On the average 3 calves need to be raised each year, and so normal would be 3 calves, 3 yearlings, and 2 2-year old heifers. Heifers usually produce the first calf at from 2½ to 3 years of age. No change is made in the other classes of livestock.

As to cropping practices, there appears to be no reason for changing the data for 1935. The yields that year were considered by the farmer to be normal in the case of all crops except potatoes. The yield of potatoes was increased from 200 to 250 bushels, which was given as normal. Only very minor adjustments were needed in feeding to take into account the increase in cows and the decrease in dairy heifers.

The next step is to scrutinize the expenses and receipts to see which items were above or below normal and the amount of the divergence.

The price of $70 each received for cows sold is above what can generally be received in this area for old cows culled from the herd. Hence this was reduced to $45 each for the 3 cows that would normally be sold. The number of calves sold and the prices received were normal for the herd and practices of the area. No change was made in receipts from the poultry, hog, or maple-sirup enterprises. Outside labor was also unchanged. Receipts from potatoes were increased as a result of the higher yield. Receipts from the sale of milk were increased slightly because of figuring on 14 instead of 13.5 cows. Total receipts were thus increased slightly from $2,274 to $2,326.

On the expense side many items remain unchanged. As nothing was spent on machinery repairs during the year a normal figure was added for this item. Similarly, the expense for repairs on buildings was increased. Grain purchases for cows and heifers were adjusted for the changes in numbers. A normal figure for veterinary services and medicine for a herd of this size was added. An estimate of normal depreciation on machinery and horses was added. This might equally well be considered as a distribution of purchases equally over each year. Total expenses were increased from $1,694 to $1,792 in the normalized budget.

This completes the normalizing process, and furnishes the basis for estimating the various details of farm organization 10 years hence with a continuance of present price relationships, with milk prices 15 percent higher, and with milk prices 15 percent lower. We shall proceed with the first of these three situations which for convenience is called A.

Perhaps the first item to consider on this farm, when looking ahead 10 years, is the labor situation. The operator is 63 years old and has a son of 23 who works full time on the farm. Another son of 14 goes to school but helps with the chores. The experience of the last decade indicates that the chances of a man of 63 continuing as a farm operator for 10 years are about 50 percent. With these facts in mind it is estimated that one son will be on the farm in 10 years and that the present operator will be doing about half the amount of work usually done by a younger man.

There is barn space for 21 cows, but it is estimated that 16 is the maximum that can be milked by the available family labor. The next question to be considered is the feed that is likely to be produced. The practice up to 1936 had been to buy fertilizer only for potatoes and to depend on manure for keeping up the fertility of the land and maintaining hay yields. Under this system it was possible to produce enough feed for a herd of about 15 cows and for the necessary replacements.

By adopting a system of reseeding every 6 years, using one-half of a ton of lime per acre before reseeding and 100 pounds of superphosphate per acre annually, it is estimated that hay yields could be increased by 0.3 ton per acre. This would make about 9½ tons more hay available. With this additional hay, four more cows could be fed according to the present feeding system. It may be noted that the present ration is higher than usual in grain and lower in hay. As the labor supply limits expansion to two more cows we may consider using a part of the additional hay to increase the rate of feeding from 2.2 to 2.5 tons per cow. Not much is known about the effects of substituting hay for grain in the ration or of simply adding hay to it. In situations of this type, however, it was assumed that about half of the additional

nutrients supplied in the hay could replace the same quantity of nutrients supplied in grains and that the other half of the additional nutrients would increase production in accordance with the percentage rule explained earlier or by 3 percent. If this were done the increase in expense for grain would be $51 and for seed, lime, and fertilizer $58, or a total for these two items of $109. Against this would be balanced an increase of $253 in returns from milk sales, assuming the additional milk to be sold at the same price. It appears that this new cropping program and the additional two cows could be handled without hiring extra labor or without significant additional expenses. Hence it is clear that it would be profitable.

An alternative A that might be considered, would be to use the additional 9½ tons of hay to raise three cows to sell. Milk production would be unchanged by such a plan. The net returns from selling cows would be balanced against the cost of the crop-improvement program. This plan, however, is estimated to be $40 less profitable than the preceding one. Hence the former appears to be more likely to be adopted.

The next point to consider is what effect a 15-percent increase in the price of milk would have. Hay yields might be increased by about 0.15 ton per acre by the addition of 50 pounds of potash per acre annually to the fertilizer treatments previously described. This plan would increase the production of hay by about 4½ tons. Since further increase in number of cows is limited this might be used to increase the rate of feeding per cow or to reduce grain feeding. An examination of present feeding practices suggests the former of these alternatives since roughage feeding has been relatively low. This would increase production per cow to 5,464 pounds, or by 7 percent above the level estimated for A. The profitableness of the potash application and increased rate of feeding may be tested by comparing this organization for the B situation with the A organization at B prices. Such a comparison shows the plan with the increased feeding more profitable by $50, and after sizing up the total situation it is estimated as most probable. This suggests that the potash treatment might also have been tried in the A situation. The B organization turns out to be $33 more profitable than the one chosen for A. It is considered, however, that this would not be sufficient incentive to bring about this degree of intensity in cropping.

We are now ready to consider adjustments that would be made to milk prices 15 percent lower than at present. In this situation, with the price of cows remaining the same, it would be considerably more profitable on this farm to raise as many cows to sell as possible than to milk the maximum number.[18] Hence a plan has been worked out going back to the present cropping system, keeping 12 cows and raising 5 heifers each year, only 2 of which would be necessary as replacements. The alternative A system with the crop improvement and 14 cows and 6 heifers raised might be considered as an alternative. This plan would be $60 more profitable than the first. The question is as to whether the crop-improvement program would be adopted under these circumstances. It is estimated that it would not and that the first organization would be the one to be followed.

[18] At first thought it may seem unrealistic to work with a 15-percent decline in milk prices relative to cow prices since the two might be expected to move together. There are, however, other factors which influence cow prices and cause substantial divergencies in the courses of the two price series.

The possibility of other enterprises being expanded must be carefully considered in the C situation. The maple-sirup enterprise is operated at full capacity for the sugar bush at the present time. One son works out on the town highways when such work is available and he can be spared from work on the farm. Such work could not be increased substantially without reducing the size of the dairy enterprise. It is not probable that this will be done. Potatoes are grown as a small enterprise to supply the family needs and a small surplus to sell. The crop is handled without special equipment or hired labor. Increased production would necessitate considerable additional equipment and probably some hired labor. It is doubtful whether there is enough good potato land on this farm to justify a larger enterprise. The poultry enterprise is on much the same basis as is the potato enterprise, except with respect to dependence on soil type. Home needs are supplied and some excess is sold. A larger enterprise would require much more labor and is not likely to be undertaken because of the personal attitudes of the operator. The hog enterprise would probably be enlarged only with a return to the selling of cream, which would make skim milk available as a feed. This man is only 3 miles from a creamery and delivers his own milk. With this rather favorable location it seems doubtful that he would go back to selling cream. Hence it appears that, within the price range considered, the major adjustments would be made within the dairy enterprise.

The results of this procedure may be summarized as in table 12.

TABLE 12.—*Results of budgetary analysis of a sample farm*

Item		Actual, 1936	Normal	A	B	C
Cows	number	13.5	14	16	16	12
Heifers raised	do	4.5	3	3	3	5
Production per cow	pounds	4,977	4,977	5,126	5,464	4,980
Total production	do	67,190	69,678	82,022	87,418	59,760
Total cash receipts		$2,274	$2,326	$2,583	$2,946	$2,085
Total cash expenses		1,694	1,792	1,902	1,981	1,702
Cash balance		$580	$534	$681	$965	$383

AREA ESTIMATES FROM INDIVIDUAL FARM PLANS

The various items in the individual farm plans for all farms in the area were totaled.[19] Table 13 gives the results for some of the more important factors. The figures in the first column indicate that in the normalizing process these totals were raised above the level for the year covered by the records except in the case of total receipts. How is this to be interpreted? If crop yields had been low that year the increased production might be in part at least an adjustment for this. But this was not the case.

The real explanation seems to be that the effects of various accidental or abnormal situations affecting production that have been found on occasional farms have been removed. This includes such items as losses from disease, sickness of farm operators, temporary reductions in cow numbers resulting from changes in operators, and destruction of buildings by fire. It is necessary to remove the effects

[19] 2 of the 215 farms used in the preceding tabulations were not included in this part of the analysis because they were out of commercial production in 1936. They were included in the 1926–36 comparisons because they were commercial dairy farms in 1926 and still occupied in 1936.

of such factors in order to deal adequately with alternative plans on an individual farm basis. But as a certain number of such situations are always present, they have a continuous effect on the total production for the area. Hence the totals for normal are too high to represent any actual situation. In the case of total receipts the explanation of the decrease seems to be that a few farms had large sales of timber, and these were entirely removed in normalizing.

TABLE 13.—*Totals of individual estimates of selected factors for 218 farms as percentages of 1936*

Factor	1936 normalized	A, same prices	B, 15-percent higher prices	C, 15-percent lower prices
	Percent	*Percent*	*Percent*	*Percent*
Number of cows	104.0	108.4	112.4	94.9
Production per cow	100.6	104.3	107.4	100.2
Total milk production	104.6	113.0	120.8	95.1
Total milk sold [1]	105.1	114.7	122.9	95.3
Value dairy products sold [2]	102.6	111.5	138.9	78.2
Total cash receipts [2]	97.9	102.9	119.2	84.9

[1] Includes quantity of cream and butter sold, converted to whole-milk basis.
[2] 109 farms for which data on expenses and receipts are available.

We must also consider the effects of this normalizing process on the A, B, and C totals. As they are built upon the normal as a base, they must also be too high or too low. Are they too high or too low by the same percentage by which the normal differs from the record total? This depends on whether or not the factors that were eliminated in normalizing were of normal or usual importance in the record year. If there was a greater-than-usual or less-than-usual amount of disease loss, for example, this would not be the case. However, the information at hand concerning conditions in 1936 suggests that the year was sufficiently normal, so that the change in the total for normal from that for the records in the case of each item may be taken as the basis for adjusting the values for A, B, and C. That is, since total milk production was 4.6 percent higher for normal than for the records, the totals for A, B, and C have been reduced by this percentage and likewise for each of the other factors. The results of making this adjustment are given in table 14.

TABLE 14.—*Area estimates of selected factors for 1946*

[1936=100]

Factor	A	B	C	Factor	A	B	C
	Percent	*Percent*	*Percent*		*Percent*	*Percent*	*Percent*
Number of cows	104.0	108.0	91.1	Value dairy products sold [1]	108.6	135.3	76.2
Production per cow	103.6	106.8	99.6	Total cash receipts [2]	105.0	121.7	86.7
Total milk production	107.8	115.3	90.7				
Total milk sold [1]	108.3	116.7	90.5				

[1] Includes quantity of cream and butter sold converted to whole-milk basis.
[2] 109 farms for which data on expenses and receipts are available.

We are now ready to consider what the results presented in table 14 mean and what significance may be attached to them. Figure 9 shows these results in terms of quantity of milk sold presented graphically in the form of a supply curve, or perhaps more correctly stated as 3 points on a supply curve. The actual values for B and C have been expressed as percentages (107.2 and 83.1, respectively) of A as is usual in dealing with supply schedules. The A totals are larger as a base than the 1936 totals used in the preceding tables. In what

sense may this be considered as a supply schedule? This necessitates going back to the basis upon which the estimates were made. The shape and position of the curve reflect certain effects of technological improvements and changes in age composition of the farm population and other factors which are definitely associated with a particular period—that between 1936 and 1946. Hence the schedule is associated with the year 1946 or at least some time fairly close to it.

On the other hand, it is a normal schedule and does not allow for any unusual situations that may exist in 1946. Thus no account is taken of whether we will be at the bottom or top of the business cycle at that particular time. Perhaps we might say that the estimate is in terms of an average for an entire business cycle centered on 1946. Likewise it does not take account of the weather conditions or other

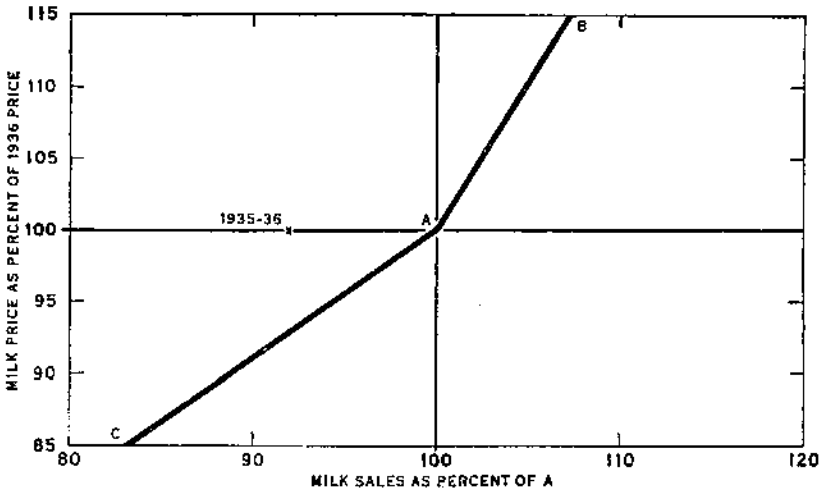

FIGURE 9.—ESTIMATED SALES (QUANTITY) OF MILK AT THREE PRICE LEVELS.

A 15-percent decline in milk prices would in 10 years bring about a contraction in quantity sold considerably greater than the expansion that would result from a similar price increase. The distance between 1935–36 and A represents changes that are estimated for a 10-year period with no change in price relationships.

short-time variations except that it is based on normality with respect to them. Thus it cannot be considered as an estimate applicable to one particular year.

Another point to be noted is that the schedule is based on a 10-year period for adjustment to each price considered. In other words, in terms of 1946, for these conditions to be fulfilled for the A or B situations it would be necessary for prices to move fairly constantly toward that level from now until that time. If prices fluctuated about the 1936 level between 1936 and 1946 we would have the A situation. If they immediately increased 15 percent and remained at about that level we would have the B situation, and correspondingly with C.

These limitations may seem rather complicated and possibly even vitiating with respect to the usefulness of the results. However, this is perhaps as good a basis as we have for estimating 10 years ahead

with respect to production of a commodity. The primary or immediate purpose, however, is not to make a final estimate of the volume of production in this area 10 years hence. It is rather to describe the conditions of supply response so that policies with respect to agriculture can be evaluated more adequately. Subsequently, when pertinent supply data for other areas and regions as well as comparable demand data are available, final production estimates may be attempted.

It may help in understanding and evaluating these results if we compare them with a statistical study of short-time-production responses covering this same area. Such a study was recently made by Johnson (*10*). For this comparison we have selected from his study a regression equation describing the average relationship between

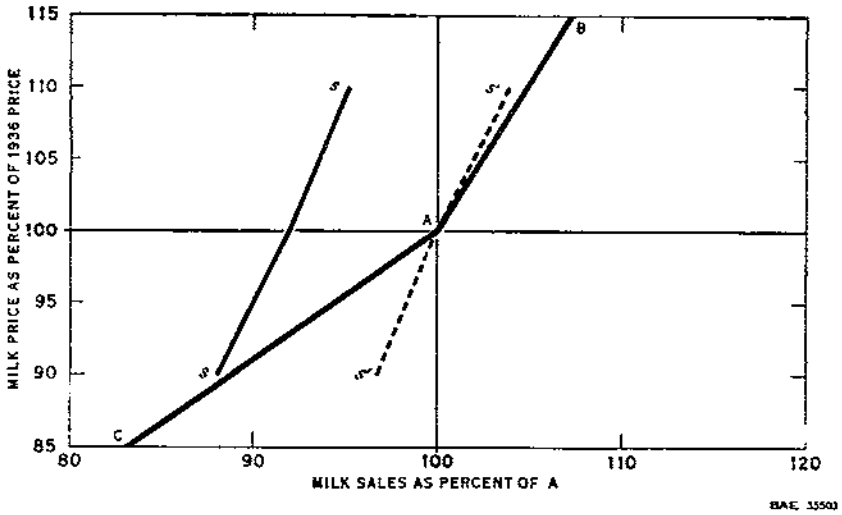

FIGURE 10.—LONG-TIME AND SHORT-TIME PRICE RESPONSES.

The 10-year supply curve, BAC, for the Cabot-Marshfield area is more elastic than a statistically derived 2-month curve, *ss*, for the same area, especially with respect to lower prices.

a monthly index of milk deliveries for patrons of the Cabot Creamery for the period 1928–36 and a 3-month cumulative average of the indexes of milk-feed-price ratios advanced 2 months. A number of other relationships that Johnson worked out might have been used in the same way. Figure 10 shows in addition to the long-time-supply curve BAC of figure 9 the supply curve *ss* represented by Johnson's regression equation. It has been drawn to cover a range from 10 percent above to 10 percent below 1936 prices. This curve should represent production responses in a given month to prices prevailing over the preceding 3 months on the basis of average 1928–36 relationships. This is the type of curve that represents the short-time response to price changes associated chiefly with changes in feeding practices. It shows much less elasticity than the long-time curve as one might expect from a priori reasoning. It may not actually be a straight line, but appears in this form because of the method by which it was derived.

If the same relationship could be assumed to prevail in the A situation, this short-time-supply curve would take the position indicated by the broken line (*s's'*) in figure 10. There might be some change in the curve during such a 10-year period, but it might very well be similar to the one drawn even after the elapse of such a period. In the A situation a 10-percent increase in price might bring about the volume of production indicated by the short-time curve with a 2-month lag. If this price were to continue in effect for 10 years it might call forth the volume of production indicated by the long-time curve.

A somewhat similar study for the patrons of 28 country plants in New York has recently been made by Parsons (*13*). (Parsons kindly made available regression equations not appearing in this bulletin.) In that study an attempt was made to measure two types of response to price changes, one occurring about 2 months later and the other about 2 years later. The 2-year supply-price relationship as measured by correlation analysis is of about the same elasticity as the supply curve worked out in this study with respect to lower prices, but more elastic with respect to higher prices. The 2-month relationship is even less elastic than the one worked out by Johnson for Cabot-Marshfield. It is difficult to say to what extent these differences represent actual differences in supply responses and to what extent they reflect differences in the methodology. It should be noted that the statistical studies relate to past responses and the present study to estimated future responses in a different period.

An interesting piece of work that reveals certain shortcomings in the use of multiple correlation technique in the measurement of supply responses has been carried out by Cassels and Malenbaum (*7*). A procedure which indicated a rather close relationship between Vermont milk production and previous prices during the period from 1919 to 1925 showed no significant relationship when applied to the period from 1922 to 1931. Although various possible explanations are explored, the present study suggests that a very significant one escaped attention. It appears that the techniques used permitted long- and short-time responses to be intermingled in different proportions as a result of different price trends in the two periods.

The main interest here is in the effect of price changes and of the other changes discussed, not only on milk production but also on farm income and farm organization. Changes in number of cows and in production per cow are included in table 13. Each accounts for about half of the increase in production in the A and B situations. This is very closely in line with what actually happened during the 10-year period preceding. In the case of the C situation, however, the decrease in number of cows accounted for nearly all of the decrease in production. Other factors, of which more roughage is probably most important, nearly counteracted the effect of a lower rate of grain feeding in the estimates.

It is of interest to find to what extent incomes varied with prices and to what extent shifts in farm organization offset the effects of lower prices and augmented those of higher prices. Table 15 provides a basis for the consideration of this point. In the A situation the increase in milk production accounts for most of the increase in cash receipts over the 1936 situation. Receipts from other sources were little changed.[20] On the expense side a small increase occurs. There is a saving of $6 per farm in purchased feed, but this is more than

offset by an increase of $36 per farm in expenses for lime and fertilizer. However, the increase in expenses averages $128 less than the increase in receipts and hence the cash balance is increased by this amount.

TABLE 15.—*Average receipts and expenses on 109 Cabot-Marshfield farms, 1936, and 3 estimates for 1946*

Item	Actual, 1936	A [1]	B	C [2]
Receipts:				
Milk and milk products	$1,376	$1,537	$1,862	$1,120
Dairy livestock	292	310	305	336
Other	668	677	676	707
Total	2,336	2,524	2,843	2,163
Expenses:				
Feed	667	691	728	612
Lime and fertilizer	23	59	68	25
Other	1,064	1,094	1,094	1,076
Total	1,754	1,844	1,890	1,713
Cash balance	582	710	953	450

[1] Only 106 farms included, as 3 were considered as abandoned.
[2] Only 102 farms included, as 7 were considered as abandoned.

In the B situation with 15-percent-higher prices for milk, receipts from the sale of milk and milk products increased 21 percent; net returns increased 34 percent. If the A farm plans were to be used with B prices the net income would be increased 33 percent. The difference between these latter two figures represents the gains to be obtained from making the adjustments worked out for the higher-price level. These adjustments are in the main of the same sort described for A. They represent a further step in the same direction, that is, more intensive cropping and feeding and some increase in number of cows.

In C, with 15-percent lower milk prices, receipts from sales of milk and milk products as worked out in the estimates would be reduced by 27 percent. Total receipts, however, would be reduced only 14 percent since there would be a small increase in receipts from the sale of dairy cows and from the enterprises other than dairying. Expenses would be reduced by 6 percent and net returns by 37 percent. With no changes from the A plan but with this lower price level, net returns would be reduced by 33 percent. At first this may seem to suggest that the procedure has not been satisfactory but there are some additional considerations. One of the most important of these is that we have estimated that in the C situation less family labor would be available. There would be less incentive for sons to remain at home on the farm. The necessary labor supply would not be available to carry out the A plans with the lower-price level. There are further limitations, such as the availability of credit, which operate in somewhat the same way.

It was noted earlier that the probable effects of more general adoption of crop-improvement practices under the C price relationships were estimated by working out a plan including such improve-

[9] It should be noted that our estimates do not take account of the probable reduction in receipts from maple products due to the permanent damage to sugar orchards caused by the hurricane of September 1938. According to information from W. G. Loveless, county agent of Washington County, about 44 percent of the tapable maple trees were destroyed. This may mean a reduction of 2 or 3 percent in total farm receipts.

ments on each of those farms on which it would be profitable and feasible if lack of credit and similar obstacles could be overcome. By adding the production that would result on these farms to the production estimated in the original plans for the remaining farms, a total is obtained that is 97.0 percent of the 1936 production. This compares with 90.7 percent for the previously described plans. Under these plans net returns would be reduced only by 14 percent as a result of the 15-percent decrease as compared with 37 percent for the original plans. This may perhaps indicate the approximate effect on production of a continuance of influences as powerful as those now operating to stimulate crop improvement.

The above analysis indicates that changes in milk prices within the range considered would have rather minor effects on agricultural enterprises other than dairying. Most of the adjustments would take place within the dairy enterprise. Specialized dairy farming would remain nearly the only type found. Net returns would be changed by a larger percentage than that by which prices changed. Nonfarm employment is probably the most important alternative to dairy production. Its importance in the C situation has not been entirely reflected in the above figures. But it is difficult to estimate how many of the family members working at nonfarm employment would continue to use the farm as a residence and add their earnings to those from the farm business. Therefore, the cash balances indicated in C would represent the returns to somewhat fewer persons than those in A and B.

Reliability and General Applicability of Findings

In this study individual farm budgets were constructed for each of the 213 dairy farms in the Cabot-Marshfield area. This is a very expensive and tedious process. Hence it is pertinent to consider the accuracy attained by such a procedure with respect to this area and the applicability of the findings to a larger area. It is also important to examine the possibilities of approaching the same results by less expensive methods.

When this work was initiated it was considered that a sample of farms might be selected which would represent the area as to responsiveness in production of dairy production to price changes and to other economic factors that enter the problem. The selection of 26 farms on the basis of factors that were thought to be significantly related to production response has been described earlier. If the factors serving as the basis for selection are actually the important ones accounting for most of the production response, the remaining farms might be classified and subclassified on the basis of these factors with a small amount of descriptive data that could be easily obtained. This would furnish a basis for deriving an area estimate from the estimates for the cases in the selected sample.

After the budget estimates were completed, scatter diagrams were made to indicate the relationship between such factors as age of operator and number of cows and percentage change in production with each of the three price situations. No significant relationships between such factors and production response were discovered. The same factors were related to the actual changes between 1926 and 1936 with similar negative results. There was some semblance

of a relationship between age of operator and response, but no factor was found to explain a significant part of the wide departures from this possible relationship. The results of these tests suggest the possibility that production responses in this area may depend on a large number of factors, no one of which is dominant. If such is the case we may expect the percentage changes in production to be arrayed in the general form of a normal frequency distribution.

An examination of the distribution of the percentage changes in production in table 16 lends some support to this hypothesis, but a number of peculiarities may be noted. In the first place, the dispersion of the actual percentage changes between 1926 and 1936 is considerably greater than that of the budgeted changes for the following 10-year period. This is because the budgeted changes are between a normal production level for each farm in 1936 and a normal level for 1946. Thus the large percentage changes that reflect an abnormally high or an abnormally low level of production for 1 of the 2 years compared are eliminated. The actual changes between 1926 and 1936 include all fluctuations of this sort. Hence the actual and budgeted changes are not directly comparable.

TABLE 16.—*Distribution of percentage changes in milk production on Cabot-Marshfield farms, actual 1926–36, normalized 1936 to estimated 1946* [1]

Percentage change	Frequencies (number)				Percentage change	Frequencies (number)			
	1926–36	1936–46 A	1936–46 B	1936–46 C		1926–36	1936–46 A	1936–46 B	1936–46 C
−100.0 to −95.1	18	17	9	27	+105.1 to +115.0	3	1		
−95.0 to −85.1	4				+115.1 to +125.0				
−85.0 to −75.1	2				+125.1 to +135.0	1			
−75.0 to −65.1	1				+135.1 to +145.0				
−65.0 to −55.1		1	1	1	+145.1 to +155.0	1			
−55.0 to −45.1	4	2	2	2	+155.1 to +165.0			1	
−45.0 to −35.1	8			1	+165.1 to +175.0	1			
−35.0 to −25.1	10	1		3	+175.1 to +185.0		1	1	1
−25.0 to −15.1	15	5	4	15	+185.1 to +195.0				
−15.0 to −5.1	7	2	2	43	+195.1 to +205.0	1			
−5.0 to +5.0	7	93	78	88	+205.1 to +215.0				
+5.1 to +15.0	15	28	40	6	+215.1 to +225.0				
+15.1 to +25.0	8	20	15	5	+225.1 to +235.0	1			
+25.1 to +35.0	5	12	16	3	+235.1 to +245.0				
+35.1 to +45.0	6	6	8		+245.1 to +255.0	1			
+45.1 to +55.0	5	3	8		+255.1 to +265.0				
+55.1 to +65.0	1	3	2	2	+265.1 to +275.0				
+65.1 to +75.0	3	1	5		+275.1 to +285.0	1			
+75.1 to +85.0	2		2		+285.1 to +295.0	1			
+85.1 to +95.0	1		2						
+95.1 to +105.0	1	1	1		Total	134	197	197	197

[1] Farms with less than 3 cows in base period not included.

The modal-class interval of the budgeted changes is that centered about no change. The distribution of the actual changes is bimodal, the modes falling on either side of the no-change group. It appears that a comparison of the output of individual farms in any given year with that of the same farms 10 years earlier will show changes for nearly every farm. Many of these changes merely reflect abnormalities of the initial or the final year used in the comparison. All farms that go out of milk production show a 100-percent decrease, and hence there is a concentration in the class interval including this figure. But the inclusion of these cases enables us to show the effects of abandonment along with those of other factors influencing production.

Some use of formal statistical measures of sampling error may be possible. In approaching this it would seem best to omit the cases in which production was discontinued. The factors that cause farm abandonment are different in part at least from those that cause other changes in production. Furthermore, their inclusion would tend to overstate the error in estimating total changes since the farms that go out of production are smaller. This means that, strictly speaking, the measures of reliability that are calculated apply only to changes on those farms which continue in production. Separate consideration must be given to the error in estimating the effects of abandonment. Since production on the farms involved is relatively small, the error from this source is likely to be small.

There appears to be no significant relationship between production per farm and percentage change in production for those farms continuing as dairy farms. This means that the unweighted average of the percentage changes for individual farms is approximately equal to the percentage change for the area as a whole. Hence the standard error of the mean of the individual farm changes may also be considered as the standard error of estimating the total change.

The standard error of estimate for the percentage change from 1936 to A is 1.78 percent. If the statistical assumptions involved in standard-error procedure are valid in this situation, this may be interpreted to mean that if another group of farms of the same size were chosen under identical conditions the chances would be 2 out of 3 that the percentage change from 1936 to A in quantity of milk produced would be within 1.78 points on a percentage scale of the estimate obtained in this study (table 14). The estimate would thus be written 7.8 percent$\pm$1.78. The errors of estimate for B and C are 2.07 and 1.51, respectively. It should be noted that this has nothing to do with any errors in the actual budgeting procedure which may affect the accuracy of the estimate for the Cabot-Marshfield area.

Standard-error procedure may also be extended to determine the sacrifice in accuracy accompanying the use of a smaller sample than the one actually used. This involves the assumption that the standard deviation of percentage changes for smaller samples would be the same as for this sample. We find that with a sample of 100 farms the standard error in estimating changes for the A situation would be 2.39 percent, and with 50 farms it would be 3.40 percent. It would appear that a random sample of 50 farms under conditions encountered in the Cabot-Marshfield area is the minimum that would be reasonably satisfactory. With such a sample the error would be 4.04 for B and 2.80 for C. It should be noted that in areas where greater variability in response exists a correspondingly larger sample would be needed for the same reliability and conversely for an area with less variability.

The original selection of the 26 farms, though not a satisfactory sampling procedure, served another useful purpose in providing a thorough testing ground for all phases of the budgeting analysis before it was applied to the remainder of the farms since much more information concerning soils and crop-improvement potentialities was obtained, as well as a more complete history of the farms and their operators.

As a further experiment a subjective classification was attempted as offering a possible short-cut method to complete budgeting. The procedure followed was first to classify these 26 selected farms into

several production-response groups, according to the estimated percentage change in production from the normal situation to the expected future production. This was done separately for the A, B, and C situations. Each of these classes was then examined and a careful description of the selected farms falling within it was written out. Having done this all the remaining farms in the area were distributed into similar classes as nearly as could be done on the basis of similarity in basic description of the selected farms. This frequently called for a subjective balancing of the importance of several joint or opposing factors. When this process was completed the normal production for each group was multiplied by the modal percentage increase indicated for the corresponding selected farm class. The area summations of the production data as estimated in this way were then corrected for farm abandonment and for normalizing as in the full analysis. The final production results are shown in table 17 in comparison with the fully budgeted results. It appears that the general estimate is in the same direction, yet the differences are noticeable. A principal objection to this procedure is that it depends on an intimate knowledge of all the farms in the area, thus requiring approximately the same amount of field work and with a considerable sacrifice in reliability of the results.

TABLE 17.—*Area estimates of milk production by short-cut extension from 26 selected farm budgets compared with full budgeting*

[1936=100]

	Short cut	Full budgeting
Plan A	109.3	107.8
Plan B	116.8	115.3
Plan C	92.9	90.7

Finally, the significance of the measures of error with respect to the extension of the results of the Cabot-Marshfield study to a larger area is to be considered. All that these measures tell us is that wherever conditions related to production response are similar, these responses may be estimated within the range of error indicated. We are dependent therefore upon outside judgments as to the homogeneity of these basic factors. There is partial, though not conclusive, evidence in the similarity of trends for all of Vermont from 1926 to 1936. The similarity in type of farming is further evidence pointing in the same direction. Within the Central Plateau, and especially in the northern part of it, basic conditions affecting production response are still more uniform. The results may be expected to have wider applicability with minor modifications, but studies of a less intensive nature are needed to ascertain the extent of departure in other sections from the Cabot-Marshfield conditions.

SUMMARY AND CONCLUSIONS

This study is based primarily upon farm-management data for the adjacent towns of Cabot and Marshfield located in north-central Vermont. The data cover 2 years, 1926 and 1936. Changes during

the intervening period are described and future trends in dairy production are estimated for three alternative price levels.

The findings with respect to the supply responses of the recent past and the probable responses of the forthcoming period are summarized in figure 11.

The broken lines in the figure represent the actual trend in production from 1926 to 1936 and the estimated probable trends in production from 1936 to 1946, corresponding to the three different price possibilities considered. A represents present prices, B 15-percent-higher milk prices, and C 15-percent-lower prices. The solid line from 1926 to 1936 represents the actual course that production took during the period because of the various disturbing elements that are

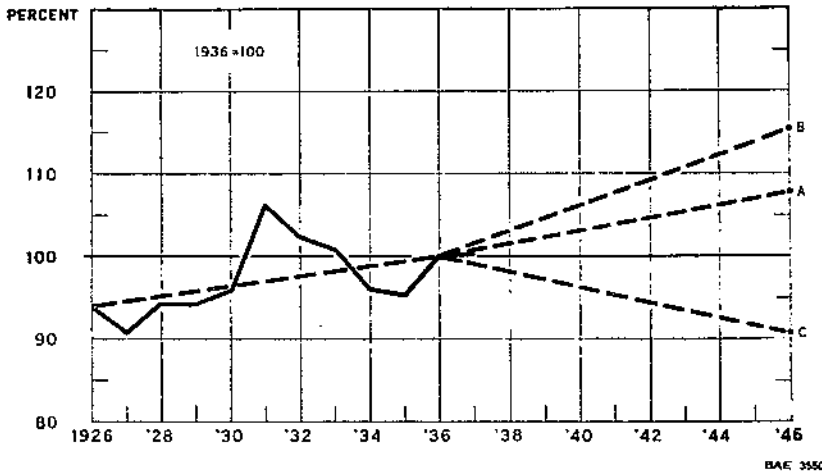

FIGURE 11.—MILK PRODUCTION IN THE CABOT-MARSHFIELD AREA AND PROBABLE FUTURE TRENDS.

Milk production fluctuated considerably between 1926 and 1936 but was at a higher level at the end than at the beginning of the period. The trend from 1936 to 1946 as estimated for A conditions has about the same slope as the actual trend from 1926 to 1936. (The broken lines represent the actual trend in production from 1926 to 1936 and the estimated probable trends from 1936 to 1946, corresponding to the three price possibilities considered.)

always introducing variability into production from year to year. The actual course of production from 1936 to 1946 will be affected by similar circumstances and will not follow a straight-trend line. The 1946 point for each price situation therefore represents an estimate of the general level at which production will be, if weather and other conditions are about normal at that time and if milk prices most of the time between 1936 and 1946 definitely tend to be in the neighborhood of the appropriate one of the three price levels considered. It is of interest that if we regard the price situation that prevailed between 1926 and 1936 as about the same as the A price situation, the estimated further increase in production to 1946 is at very nearly the same rate. There will probably be an increased production of roughage resulting from improved cropping practices. This is expected to

bring about an increase in milk production comparable to that which accompanied the earlier shift from cream to whole-milk deliveries.

The larger increase estimated for the B (or 15-percent-higher price) situation is due principally to an estimated increase in grain feeding as well as a somewhat greater adoption of improved cropping practices. The decrease in the C (or 15-percent-lower price) situation is related to less adoption of improved cropping practices, a lower rate of grain feeding, and a somewhat greater rate of farm abandonment.

The substantial decline in net returns likely to accompany a 15-percent decline in milk prices might be avoided in part by a more general adoption of crop-improvement practices. Such obstacles as lack of credit, lack of knowledge, and inertia, which would stand in the way of crop improvement, could only be overcome in this situation by an active program of education and perhaps some financial assistance.

As has been noted, a number of other forces, many of them offsetting, have been and will continue to be working to affect supply responses in addition to those just mentioned. These have been taken into account in the course of the budgeting process.

It appears that the findings for the Cabot-Marshfield area may have wider significance. The 1926–36 changes in production for the whole State of Vermont were similar to those for Cabot-Marshfield. Since the principal forces expected to determine the net supply responses during the coming period are likely to operate throughout Vermont in much the same way, similar directional changes to those found for Cabot-Marshfield may be expected. This would be particularly true for the Central Plateau where soil and cropping conditions are most like those in Cabot-Marshfield.

Of still wider significance is the distinction drawn between short- and long-time-supply responses and the definite conclusion that the long-time responses have greater elasticity. This may help in explaining apparent discrepancies found in earlier supply-response studies which were formerly ascribed to other causes, and which led to uncertainty concerning the practical value of the findings. It also means that the difference in elasticity of supply for long and short periods is of greater practical importance in the determination of price policies than has been generally recognized.

Finally, this study attempts to combine and integrate an analysis of reasons for historical changes in farm organizations and production with an exhaustive budget-estimate analysis of probable future responses to different levels of price. It therefore represents a departure from established methodology. Although both types of analysis have been used separately and for other purposes, neither has before been used as intensively nor in combination for the purpose to which they are here directed; namely, to gain an understanding of supply responses and to provide a more definite way of estimating what supply of a given farm product will be forthcoming, say 10 years later, if its price should definitely rise to a level 15 percent higher relative to other prices and remain there so that producers believe it will stay; and similarly for lower prices. Therefore, the study here described represents a new departure in methodology and should be useful in developing the further procedure which is needed in the analysis of interregional competition and related problems.

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APPENDIX

TABLE 18.—*Number of farms and land in farms in Washington County, Vt., as reported by the U. S. Census of Agriculture, 1850–1935*

Year	Farms	Land in farms	Year	Farms	Land in farms	Year	Farms	Land in farms
	Number	*Acres*		*Number*	*Acres*		*Number*	*Acres*
1850	.....	285,893	1890	2,894	355,456	1925	2,391	297,429
1860	.....	310,583	1900	2,916	378,497	1930	2,178	303,756
1870	3,006	359,651	1910	2,830	369,640	1935	2,143	301,364
1880	3,229	394,881	1920	2,564	316,799			

TABLE 19.—*Production of butter in northern New England, 1849–1929*

Year	Maine			New Hampshire			Vermont		
	Farm	Factory	Total	Farm	Factory	Total	Farm	Factory	Total
	1,000 pounds	*1,000 pounds*	*1,000 pounds*	*1,000 pounds*	*1,000 pounds*	*1,000 pounds*	*1,000 pounds*	*1,000 pounds*	*1,000 pounds*
1849	9,244	.....	9,244	6,977	.....	6,977	12,138	.....	12,138
1859	11,688	.....	11,688	6,957	.....	6,957	15,900	.....	15,900
1869	11,636	.....	11,636	5,965	.....	5,965	17,844	.....	17,844
1879	14,104	6	14,110	7,247	99	7,346	25,241	5	25,246
1889	15,593	1,406	16,999	7,943	1,920	9,863	23,314	5,085	28,399
1899	16,174	4,461	20,635	6,386	5,034	11,420	18,835	22,453	41,288
1909	13,299	2,106	15,405	5,065	1,740	6,805	15,166	20,227	35,393
1919	10,856	1,272	12,128	3,240	517	3,757	3,877	12,883	16,760
1929	8,188	256	8,444	1,768	28	1,796	2,218	3,776	5,994

Farm production from U. S. Census of Agriculture reports. Factory production from Fourteenth Census, vol. 5, p. 661, except for 1929, which is from Yearbook of Agriculture.

TABLE 20.—*Receipts of milk and cream, in terms of whole milk, by Vermont creameries, 1917–37*

Year	Receipts	Year	Receipts	Year	Receipts	Year	Receipts
	Pounds		*Pounds*				
1917	651,358,000	1923	928,807,000	1928	939,422,000	1933	944,806,000
1918	656,814,000	1924	957,380,000	1929	894,071,000	1934	916,189,000
1919	744,394,000	1925	948,367,000	1930	955,900,000	1935	977,867,000
1920	818,931,000	1926	942,279,000	1931	984,088,000	1936	1,013,648,000
1921	895,753,000	1927	951,661,000	1932	980,499,000	1937	991,263,000
1922	907,530,000						

Since 1924, with the exception of 1928, these data have been published by counties in the biennial reports of the Vermont commissioner of agriculture. For the years prior to 1924 they were secured by the Bureau of Agricultural Economics directly from the files of the Vermont Department of Agriculture. The 1928 data have since been published by the Vermont commissioner of agriculture in a separate pamphlet. In the 1930–32 report revised figures for 1929 were included and have been used here.

TABLE 21.—*Prices and index numbers of butterfat and feed and index numbers of deliveries of milk and cream, butterfat basis, Cabot-Marshfield, 1922–38*

Year ended Apr. 30	Butterfat [1]		Feed [2]		Deliveries of milk and cream [3]	
	Price per pound	Index numbers	Price per ton	Index numbers	Index numbers	Index numbers corrected for farm abandonment
	Cents		*Dollars*			
1922	46.3	95.7	41.35	94.8	93.6	
1923	52.6	108.7	45.65	104.7	95.4	
1924	54.1	111.8	50.20	115.1	97.4	
1925	49.6	102.5	50.95	116.9	95.3	
1926	53.7	111.0	49.99	114.7	94.8	94.0
1927	55.9	115.5	46.92	107.6	92.3	90.7
1928	56.3	116.3	50.95	116.9	96.9	94.4
1929	58.7	121.3	54.85	125.8	97.7	94.3
1930	58.8	121.5	51.96	118.9	100.2	95.9
1931	51.0	105.4	44.56	102.2	111.5	106.3
1932	37.5	77.5	32.92	75.5	108.2	102.2
1933	31.4	64.9	27.66	63.4	107.6	100.7
1934	35.4	73.1	34.23	78.5	103.6	96.0
1935	44.9	92.8	39.84	91.4	103.8	95.2
1936	44.4	91.7	35.89	82.3	109.5	100.0
1937	45.7	94.4	42.42	97.3	110.5	100.1
1938	45.8	94.6	40.92	93.9		

[1] Butterfat price is weighted annual average for all deliveries of cream and milk by a representative group of Cabot-Marshfield producers. Index is a percentage of the average for the period.

[2] Feed price is an average price paid by farmers in New England for the dairy ration most commonly used and is computed by W. H. Bronson of the New England Milk Producers Association. Index is a percentage of the average for the period.

[3] Index of deliveries is unweighted annual average of monthly indexes calculated by Johnson (*10*) App. table D. It represents changes for the Cabot-Marshfield area on a per-farm basis. The figures for the last year not covered in Johnson's study were calculated in a similar manner. The index of deliveries was 15.5 percent higher in 1936 than in 1926. However, farms accounting for 8 percent of the production in 1926 had been abandoned in 1936. Hence the increase was only 6.3 percent ([100−8]×15.5)−8=6.3 on the base of total production for the area in 1936. Since the actual 1926 index was 94.8 for 1926, a 6.3-percent increase would have made it 100.8 in 1936 instead of 109.5. Thus abandonment reduced the index 8.7 in 10 years, or 0.87 per year. The corrected index was obtained by subtracting this figure multiplied by the number of years having elapsed since 1926, and then by dividing the figure for each year by 100.8 to make 1936 the base year.

TABLE 22.—*Milk and cream (butterfat basis), deliveries by 22 continuous producers, Cabot-Marshfield, 1924–38* [1]

Year ended Apr. 30	Deliveries of milk and cream, butterfat basis	Year ended Apr. 30	Deliveries of milk and cream, butterfat basis	Year ended Apr. 30	Deliveries of milk and cream, butterfat basis	Year ended Apr. 30	Deliveries of milk and cream, butterfat basis
	Pounds		*Pounds*		*Pounds*		*Pounds*
1924	71,260	1928	74,090	1932	81,112	1936	73,550
1925	74,742	1929	75,842	1933	75,421	1937	84,782
1926	67,655	1930	80,472	1934	73,946	1938	77,066
1927	71,614	1931	76,814	1935	79,907		

[1] Records secured from creameries and receiving stations.

TABLE 23.—*Representative price series, per pound for milk and cream, butterfat basis, in the Cabot-Marshfield area, 1930–38* [1]

Year ended Apr. 30	Milk	Cream	Year ended Apr. 30	Milk	Cream	Year ended Apr. 30	Milk	Cream
	Cents	*Cents*		*Cents*	*Cents*		*Cents*	*Cents*
1930	64	52	1933	34	25	1936	47	36
1931	53	42	1934	39	30	1937	47	38
1932	40	33	1935	50	38	1938	46	37

[1] Records secured from creamery. Unweighted annual (May–April) averages of monthly prices. Cream price applies to all patrons of 1 creamery. Milk price is for 1 representative patron of the same creamery.

TABLE 24.—*Prices of principal Vermont farm products, 1921–38* [1]

Year	Price					Price indices 1921–30=100				
	Butterfat per pound	Milk cows	Eggs per dozen	Hogs per 100 pounds	Potatoes per bushel	Butterfat	Milk cows	Eggs	Hogs	Potatoes
	Cents	*Dollars*	*Cents*	*Dollars*	*Dollars*					
Average 1921–30	53.7	$1.02	37.0	9.38	1.18					
1921	46.3	84.70	40.0	8.00	1.13	86	80	110	85	96
1922	52.6	83.70	34.7	8.70	1.01	98	79	94	93	86
1923	54.1	82.60	35.9	7.70	1.05	101	77	97	82	89
1924	49.6	84.20	35.0	7.90	.74	92	79	95	84	63
1925	53.7	70.20	38.7	10.70	1.98	100	87	105	114	168
1926	55.9	76.70	38.2	12.10	1.45	104	95	103	129	123
1927	56.3	95.80	36.0	9.90	1.27	105	118	97	106	108
1928	58.7	105.10	37.4	9.10	.82	109	130	101	97	69
1929	58.8	111.71	38.0	10.10	1.45	110	138	105	108	123
1930	51.0	95.44	34.6	9.60	.86	95	118	94	102	73
1931	37.5	72.62	26.8	7.00	.48	70	90	72	75	41
1932	31.4	54.01	22.4	4.50	.47	58	67	61	48	40
1933	35.4	47.26	20.7	4.35	1.05	66	58	56	46	89
1934	44.9	46.61	24.6	5.40	.46	84	58	66	58	39
1935	44.4	63.71	29.7	8.60	.95	83	79	80	92	81
1936	45.7	71.22	28.6	9.00	1.15	85	88	77	96	97
1937	45.8	71.62	27.9	9.20	.63	85	88	75	98	53
1938		70.27	29.1	7.60	.80		87	79	84	68

[1] Prices of all products except butterfat are Bureau of Agricultural Economics estimates for the State. Butterfat price is the average actually received by a representative group of Cabot-Marshfield farmers. Butterfat price is average for 12 months beginning with May of the year indicated.

TABLE 25.—*Age distribution of farm operators in Vermont and selected States in 1930*

Age (years)	Percentage of all farm operators				Age (years)	Percentage of all farm operators			
	Vermont	Minnesota	Northern States [1]	United States		Vermont	Minnesota	Northern States [1]	United States
Under 25	1.5	2.4	2.7	0.1	45 to 54	25.3	24.0	24.7	24.6
25 to 34	11.4	18.1	15.4	17.3	55 to 64	22.7	18.1	19.4	17.5
35 to 44	21.4	27.0	24.9	23.9	65 and over	17.7	10.4	12.9	11.1

[1] Includes New England, Middle Atlantic, East North Central, and West North Central States.

United States Census of Agriculture.

TABLE 26.—*Age distribution of Cabot-Marshfield farm operators 1926 and 1936*

Age (years)	1926		1936		Age (years)	1926		1936	
	Operators	Percentage of total	Operators	Percentage of total		Operators	Percentage of total	Operators	Percentage of total
	Number		*Number*			*Number*		*Number*	
23 to 27	2	1.5	2	0.9	63 to 67	11	8.2	25	11.8
28 to 32	10	7.4	12	5.7	68 to 72	8	5.9	8	3.8
33 to 37	9	6.7	16	7.6	73 to 77	2	1.5	9	4.2
38 to 42	20	14.8	33	15.6	78 to 82			3	1.4
43 to 47	17	12.6	20	9.4	83 to 87	2	1.5		
48 to 52	20	14.8	28	13.2	88 to 92	1	.7		
53 to 57	20	14.8	31	14.6	Total	135	100.0	[1] 212	100.0
58 to 62	13	9.6	25	11.8					

[1] 3 farmers' ages were not reported.

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