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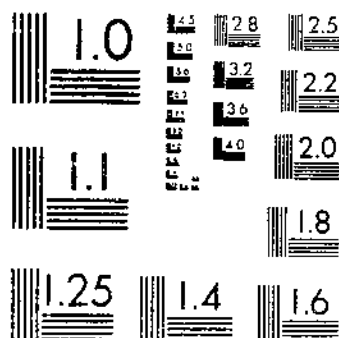
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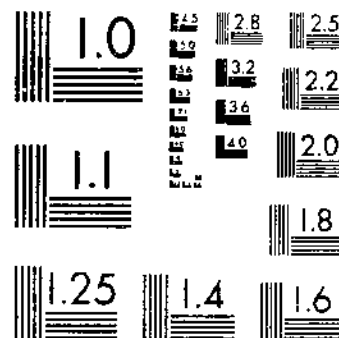
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SOME FACTORS AFFECTING THE DEMAND FOR MILK AND CREAM IN THE METROPOLITAN  
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UNITED STATES DEPARTMENT OF AGRICULTURE  
WASHINGTON, D. C.

# SOME FACTORS AFFECTING THE DEMAND FOR MILK AND CREAM IN THE METROPOLITAN AREA OF NEW YORK

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## INTRODUCTION

Milk presents a very difficult marketing problem because of certain peculiarities in its production and handling which are lacking with most farm products. Because of its high perishability it can not be stored in its natural form as can apples, potatoes, or wheat. Then there is a continuous supply instead of an annual harvest. If production exceeds the fluid-milk demand, the surplus is manufactured into less perishable products which find ready sale in world markets. The price obtained for this surplus milk, however, is usually less than that paid for fluid milk in city markets.

This is particularly true in New York, where butter, cheese, and condensed milk, produced under conditions of high cost, must compete in the open market with the same products from the cheaper-producing regions of the mid-West. It costs less to ship a pound of butter from Iowa to New York than to ship sufficient corn to produce a pound of butter in New York State. Nevertheless, the availability of extensive pasture acreage in the State of New York has resulted in maintaining there a dairy industry which, during the greater part of the year, supplies far more milk than is consumed in fluid form by the great urban population of the neighboring cities.

These cities have been demanding more and more milk each year, but even in 1925 only 52.1 per cent of the milk handled in New York State milk plants was used as fluid milk.<sup>1</sup> During the same year, however, there was a period when the New York City supply was barely adequate to meet the demand for fluid milk. That is, supply and demand are not in adjustment, and seasons of shortage alternate with seasons of surplus.

A few perishable farm products, like cantaloupes or lettuce, are like milk in that they can not well be stored. These products are even more seasonal in their production than is milk; yet they are usually consumed as they are produced because lower prices stimulate consumption during the season of heavy production. The demand for milk, on the other hand, does not seem to respond in the same way. Because of these unusual characteristics of milk, the successful marketing of this commodity requires a much more careful analysis of demand than is needed in the case of some farm products. The following study of the demand for milk was undertaken to furnish this much-needed information for the New York milk market. Specifically, the study has four principal aims:

1. To determine the factors which affect demand and to measure their influence.
2. To determine the quantities of different products demanded throughout the year, so that production may be intelligently adjusted.
3. To formulate a method of forecasting sales of milk and cream in order to decrease the surplus necessary to guard against shortages due to unexpected fluctuations in demand.
4. To quantitatively analyze demand as a factor in milk prices.

#### SOURCE OF DATA

If the cooperation of all the milk dealers in a city is obtained, it is possible to gather data which will give the total current sales for that market. Such figures, however, show demand only as it exists at a particular time. Sales at other times may be entirely different. For a complete analysis of demand, detailed records covering a long period are necessary. Unfortunately, only the largest dealers keep such records, and it is therefore impossible to get long-time records which include all sales for a given city. In New York, however, the milk-distributing business is sufficiently concentrated so that the available records cover the major part of the milk sales in the city.

In this study, sales records were obtained directly from the books of six of the largest distributors. The periods covered varied according to the nature of the records and the length of time that they had been kept by the different dealers. Many of the data cover the period from 1919 to 1924, except for one year (November 1, 1921, to October 31, 1922), which is omitted because of the milk-drivers' strike. Accurate sales records are lacking for the early part of the period omitted, and those available are not typical because of the disruption of business.

<sup>1</sup> NEW YORK STATE DEPARTMENT OF FARMS AND MARKETS. STATISTICS RELATIVE TO THE DAIRY INDUSTRY IN NEW YORK STATE, 1925. N. Y. State Dept. Farms and Markets, Agr. Bul. 192: 29. 1926.

During the last year of the period studied (1924), records were obtained covering the sales of 765,842,560 quarts of milk. According to the Milk Reporter, the total receipts of milk in the metropolitan district during that year were 1,195,861,040 quarts. The analysis covered, therefore, 64 per cent of all the milk shipped to the New York market. The retail business was covered even more completely since these six dealers handled approximately 94 per cent of all the milk sold at retail and 96 per cent of all the cream. With such a large part of the milk business included, it is felt that the data presented here are undoubtedly typical of the whole city except in a few minor instances which are noted later in the discussion.

Supplementary data were obtained through the courtesy of the New York City Department of Health, which made a survey of the businesses of 38 of the larger milk dealers in the early part of 1927. This was done for the purpose of securing the latest information on the proportionate quantities of the various grades of milk and cream sold.

New York City and the surrounding towns and suburbs constitute one large market for milk, subject to certain minor variations in price and sanitary requirements. The largest dealers have distributing branches scattered throughout the territory. These branches are necessary because only a limited number of retail wagons can distribute from a given point without too long hauls. The number of retail routes to a branch may vary from 25 to 200. Branches in the sparsely settled regions operate the smallest number of retail wagons. Routes in the densely populated area are much shorter and a greater number can be handled by a single branch.

Most of the region covered by the study is shown in Figure 1, and this figure will serve as a key map for the districts given in many of the tables. Each district represents the territory served by the retail wagons from a single distributing branch. In addition to the area shown in this map, the records include sales to districts around Stamford and Bridgeport, Conn., and around Asbury Park, N. J. For convenience in locating the various districts they are grouped under eight headings, including the five boroughs of New York and three other districts here referred to as Long Island, Westchester County, and New Jersey.

The records as obtained from the books of the dealers were of three kinds: (1) Monthly sales, (2) weekly sales, and (3) daily sales, of the various products ordinarily handled by milk distributors. Monthly and weekly sales for all commodities, and daily sales for the most important ones, cover the whole metropolitan area. Because of the large amount of work involved in copying daily-sales records for the 42 districts included, only certain of these districts are given for some of the minor dairy products. In the case of these less important products, it was thought that this "sampling" method was sufficiently accurate to give dependable estimates for the whole area.

#### GRADES OF MILK AND CREAM SOLD

The average daily receipts of milk at the New York market during February, 1927, amounted to 3,522,520 quarts. Of this quantity, 2,726,283 quarts, or 77.4 per cent, was sold by the 41 dealers whose

sales are shown in Table 1.<sup>2</sup> Approximately four-fifths of this quantity was grade B milk and one-fifth was grade A. Certified milk constituted only about 1 per cent of the total sales.

TABLE 1.—Average daily sales of milk by 41 dealers in the New York metropolitan area during February, 1927

Commodity	Average daily sales	
	Quarts	Per cent
Grade B milk.....	2,193,105	79.3
Grade A milk.....	527,020	19.4
Certified milk.....	35,552	1.3
Total.....	2,726,283	100.0

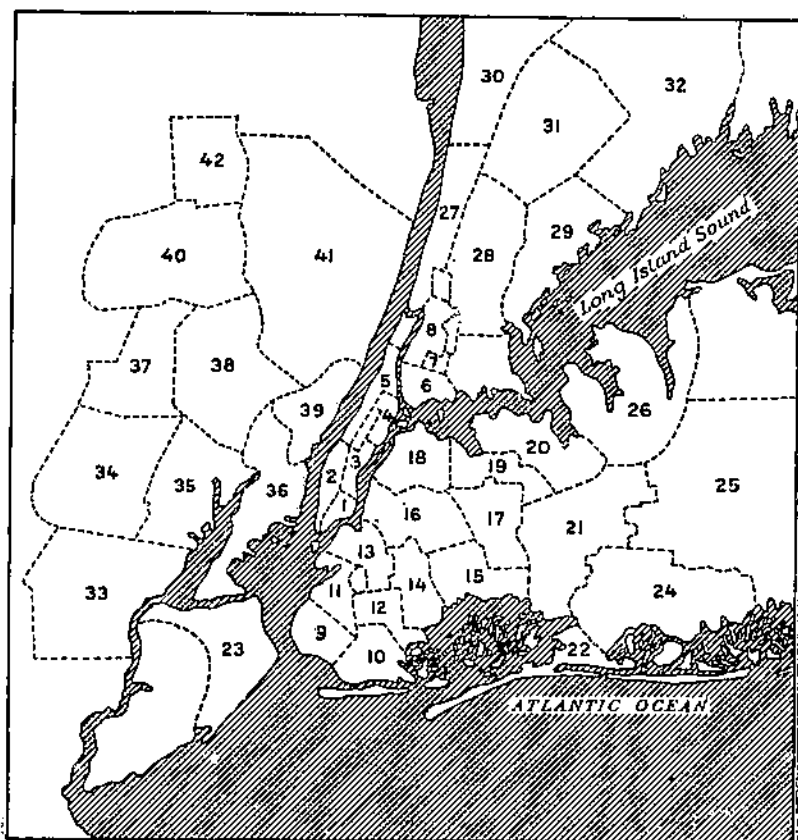


FIG. 1.—KEY MAP OF THE NEW YORK METROPOLITAN AREA

The territory includes the five boroughs of New York, and parts of Long Island, and Westchester County, N. Y., and New Jersey. Each district represents the territory served by retail wagons from a single distributing branch.

During the same month these dealers sold 76.2 per cent of all the cream received at the market. The amount sold and the butterfat test for each of the different classes of cream are shown in Table 2.

<sup>2</sup> Thirty-eight records were obtained by the New York City Department of Health and three were obtained directly from New Jersey dealers.

The actual fat content ranged from 1.86 to 5 per cent above the legal minimum established by the New York City Department of Health. Extra-heavy cream, with an average fat test of 39.55 per cent, constituted about 70 per cent of the total sales. New York offers an excellent market for cream in that it demands large quantities of the high-testing product. Roughly, five bottles of heavy cream are sold at retail for each bottle of light and medium cream. Contrasted with this is the Chicago market, which in 1922 demanded 10 bottles of light cream for each bottle of heavy.<sup>3</sup> In the latter city the heavy cream tested only 32 per cent fat, as compared with nearly 40 per cent for New York.

TABLE 2.—Average daily sales of cream by 41 dealers in the New York Metropolitan area during February, 1927

Kind of cream	Butterfat content		Quantity sold	
	Legal minimum in New York City	Actual		
	Per cent	Per cent	Quarts	Per cent
Light.....	18	19.88	24,428	23.2
Medium.....	23	27.41	7,084	6.7
Extra heavy.....	36	39.55	73,247	69.6
Special extra heavy.....	45	50.00	460	.5
Total.....		34.16	105,225	100.0

<sup>1</sup> Weighted average.

The channels through which the products handled by these 41 dealers reached the consumer are shown in Tables 3 and 4. Of all the milk sold, 54 per cent was sold on retail routes, and about 9 per cent was sold in bottled form through stores, leaving 37 per cent which was sold as bulk milk. Twenty-five of the dealers divided their bulk sales into two classes—that part going to stores to be resold as dipped milk, and that part going to restaurants, hotels, and the like, to be served to consumers or used in cooking and ice-cream making. Approximately equal quantities were used in the two classes, and it seems likely that this proportion would hold true for the dealers not reporting.

Practically all of the bulk milk was grade B, and so the proportion of this grade sold in bulk form is much larger than that of all milk (46.5 per cent as compared with 36.9 per cent). Only a very small quantity of grade A milk was sold in bulk form, and no certified milk. Retail sales constituted 93 per cent of the total sales of grade A milk and 97 per cent of the total sales of certified milk.

Approximately one-eighth of the light cream and one-fourth of the heavy cream was handled on retail routes; the rest was sold in bulk and bottled form to such customers as hotels, restaurants, confectioners, and ice-cream makers.

<sup>3</sup> Ross, H. A. THE MARKETING OF MILK IN THE CHICAGO DAIRY DISTRICT. Ill. Agr. Expt. Sta. Bul. 280: 490. 1925.



TABLE 3.—Percentage distribution of sales of milk by 41 dealers in the New York metropolitan area during February, 1927

Sales method	Grade B milk		Grade A milk		Certified milk		All grades	
	Quarts	Per cent	Quarts	Per cent	Quarts	Per cent	Quarts	Per cent
Retail, bottled.....	655,715	44.2	491,570	93.2	34,509	97.1	1,481,800	54.4
Wholesale, bottled.....	291,082	9.3	33,795	6.4	1,043	2.9	230,500	8.7
Stores, bulk.....	520,713	24.1			0	0	520,713	19.1
Restaurants, etc., bulk.....	436,015	22.4	2,255	.4	0	0	437,270	17.8
Total.....	2,103,105	100.0	527,626	100.0	35,552	100.0	2,726,283	100.0

<sup>1</sup> 16 of the 41 dealers did not differentiate between store and restaurant bulk sales. Their bulk sales were therefore divided between stores and restaurants in the same proportion as those of the 25 dealers who reported them separately.

TABLE 4.—Percentage distribution of sales of cream by 41 dealers in the New York metropolitan area during February, 1927

Sales method	Light and medium cream		Extra-heavy cream		All cream	
	Quarts	Per cent	Quarts	Per cent	Quarts	Per cent
Retail.....	3,916	12.4	18,300	25.6	22,212	21.7
Wholesale.....	27,598	87.6	54,817	74.4	82,413	78.3
Total.....	31,512	100.0	73,713	100.0	104,625	100.0

## DAILY RETAIL SALES PER FAMILY

Different parts of any cosmopolitan city like New York show great diversity in the demands for dairy products. Although it is not the purpose of this study to relate demand to the social or the racial characteristics of the population, certain data are given for the separate districts which make up the metropolitan area. For a small dealer who serves only one section of a city and for the dairymen who sell milk to such a dealer these district data may be more representative than are the figures for the market as a whole.

The boundaries of the districts are determined by the area covered by the retail wagons distributing from a single branch. In a few of the more congested parts of the metropolitan area the population is highly varied, and the same distributing branch may serve a millionaire on Park Avenue and a destitute garment worker on Avenue B. Hence the data on average sales per family in such a district mean little from a sociological standpoint. Most of the districts, however, are characterized by distinctive features, such as business, resort, and suburban sections, or poor, middle class, and wealthy homes.

The daily retail sales per family shown in Tables 5 and 6 were obtained by dividing the total retail sales of each product by the average number of active customers as shown by the books of the route men on the first day of each month. Obviously, such data on the average sales per family for any given product do not mean that each family buys some of the commodity each day. For example, certified milk is purchased by a relatively small proportion of the families in a district, whereas cream may be purchased every day, or

occasionally, or not at all. The average sales per family, however, put the different districts on a common basis, so that the relative intensity of sales is indicated. This is shown graphically in Figure 2.

The lowest average sales per family, 1.067 quarts, were found in the district about Paterson, N. J. (district 40). The heaviest sales per family were shown in district 31, which includes the towns of White Plains, Hartsdale, Scarsdale, and Harts Corners, in Westchester County. Sales in this district amounted to 1.546 quarts per family, or 45 per cent more than in district 40. There is no doubt

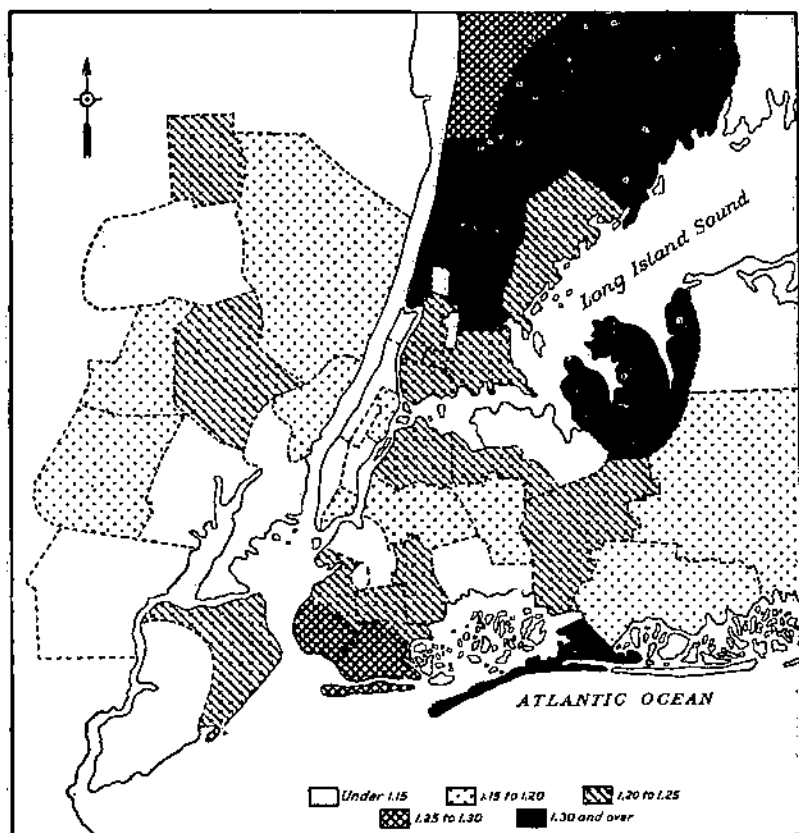


FIG. 2.—AVERAGE DAILY RETAIL SALES OF ALL MILK IN QUARTS PER FAMILY, NEW YORK METROPOLITAN AREA, 1924

Sales are heaviest in some of the better-class suburban districts

that the low retail sales in some of the New York City districts are due to the fact that a part of the family supply is purchased at stores. It is not unusual for a poor family to purchase bottled milk from the retail wagons for the children and to supplement this with dipped milk from the store for consumption by the adult members. Since the suburban districts depend almost wholly on retail deliveries the per family purchases are necessarily higher. In addition there is a strong tendency for families with children to move to these suburban regions, and this may explain a part of the heavier demand per

family. The rest of the variation in sales between different districts may be accounted for largely by racial or economic differences in the population.

TABLE 5.—Average daily retail sales of bottled milk per family in the New York metropolitan area, 1924

District	Grade B milk	Grade A milk	Certified milk	Grade B milk	All bottled milk
<b>Manhattan:</b>	<i>Quarts</i>	<i>Quarts</i>	<i>Quarts</i>	<i>Pints</i>	<i>Quarts</i>
1.....	0.491	0.566	0.014	0.179	1.160
2.....	.024	.361	.015	.213	1.006
3.....	.951	.387	.024	.168	1.146
4.....	.740	.306	.015	.083	1.194
5.....	.653	.369	.020	.105	1.104
<b>Bronx:</b>					
6.....	.722	.467	.015	.057	1.222
7.....	.734	.444	.018	.090	1.226
8.....	.739	.448	.020	.065	1.248
<b>Brooklyn:</b>					
9.....	.830	.373	.034	.083	1.278
10.....	.771	.415	.038	.068	1.258
11.....	.820	.323	.028	.093	1.218
12.....	.769	.347	.057	.084	1.215
13.....	.735	.307	.033	.129	1.140
14.....	.656	.519	.026	.053	1.229
15.....	.751	.301	.023	.056	1.133
16.....	.706	.422	.021	.067	1.182
<b>Queens:</b>					
17.....	.827	.271	.034	.067	1.160
18.....	.844	.283	.017	.129	1.268
19.....	.881	.280	.024	.085	1.229
20.....	.797	.263	.046	.088	1.140
21.....	.925	.244	.026	.061	1.226
22.....	.827	.422	.046	.051	1.320
<b>Staten Island: 23.....</b>	.818	.368	.026	.038	1.231
<b>Long Island:</b>					
24.....	.825	.265	.037	.045	1.150
25.....	.809	.262	.064	.085	1.178
26.....	.904	.417	.084	.083	1.490
<b>Westchester County:</b>					
27.....	1.084	.229	.015	.077	1.366
28.....	1.050	.271	.031	.076	1.390
29.....	.828	.323	.046	.078	1.236
30.....	.903	.290	.042	.080	1.275
31.....	1.018	.431	.070	.055	1.546
32.....	.970	.328	.039	.063	1.368
<b>New Jersey:</b>					
33.....	.745	.327	.018	.078	1.129
34.....	.692	.448	.018	.074	1.195
35.....	.748	.321	.016	.094	1.132
36.....	.777	.280	.024	.093	1.128
37.....	.325	.604	.042	.032	1.187
38.....	.900	.263	.024	.061	1.218
39.....	.772	.284	.065	.063	1.162
40.....	.778	.249	.015	.050	1.067
41.....	.833	.296	.036	.067	1.190
42.....	.830	.333	.044	.057	1.236
<b>Weighted average.....</b>	.756	.372	.028	.086	1.202

TABLE 6.—Average daily retail sales of cream per family in the New York metropolitan area, 1924

District	Extra-heavy cream	Light cream	All cream	Total milk equivalent <sup>1</sup>
<i>Manhattan:</i>	<i>Half pints</i>	<i>Half pints</i>	<i>Half pints</i>	<i>Pounds</i>
1.....	0.016	0.004	0.020	0.107
2.....	.028	.008	.036	.190
3.....	.091	.018	.109	.562
4.....	.047	.005	.052	.263
5.....	.097	.020	.117	.633
<i>Bronx:</i>				
6.....	.029	.002	.031	.177
7.....	.025	.003	.028	.157
8.....	.036	.007	.043	.234
<i>Brooklyn:</i>				
9.....	.029	.005	.034	.180
10.....	.043	.007	.050	.275
11.....	.044	.005	.049	.276
12.....	.032	.010	.042	.515
13.....	.060	.007	.067	.378
14.....	.030	.004	.034	.189
15.....	.028	.006	.034	.184
16.....	.025	.004	.029	.160
<i>Queens:</i>				
17.....	.051	.017	.068	.353
18.....	.043	.007	.050	.275
19.....	.051	.015	.066	.346
20.....	.095	.020	.115	.622
21.....	.048	.013	.061	.323
22.....	.067	.007	.074	.417
<i>Staton Island: 23</i>	.066	.018	.084	.444
<i>Long Island:</i>				
24.....	.071	.006	.077	.438
25.....	.121	.013	.134	.754
26.....	.150	.038	.198	1.060
<i>Westchester County:</i>				
27.....	.060	.014	.074	.397
28.....	.078	.019	.097	.518
29.....	.107	.029	.136	.720
30.....	.111	.021	.132	.719
31.....	.179	.050	.229	1.226
32.....	.120	.044	.164	.751
<i>New Jersey:</i>				
33.....	.042	.017	.059	.290
34.....	.054	.023	.077	.388
35.....	.032	.011	.043	.222
36.....	.027	.007	.034	.181
37.....	.148	.044	.192	1.007
38.....	.048	.014	.062	.323
39.....	.036	.012	.048	.240
40.....	.038	.006	.044	.243
41.....	.074	.012	.086	.473
42.....	.104	.029	.133	.702
Weighted average.....	.053	.011	.064	.346

<sup>1</sup> 3.0106 pounds of 3.5 per cent milk = one-half pint light cream; 5.9086 pounds = one-half pint extra-heavy cream.

The average daily sales of all milk on retail routes were 1.202 quarts per family for the entire metropolitan area. Grade B quarts constituted 63.1 per cent of this total; grade A quarts, 31 per cent; certified quarts, 2.3 per cent; and grade B pints, 3.6 per cent. The proportionate amounts of these grades differed widely in the various districts. (Table 7 and figs. 3 and 4.) In spite of the rapid increase in the demand for grade A milk during the period covered, the principal unit sold in all but two of the districts was the quart of

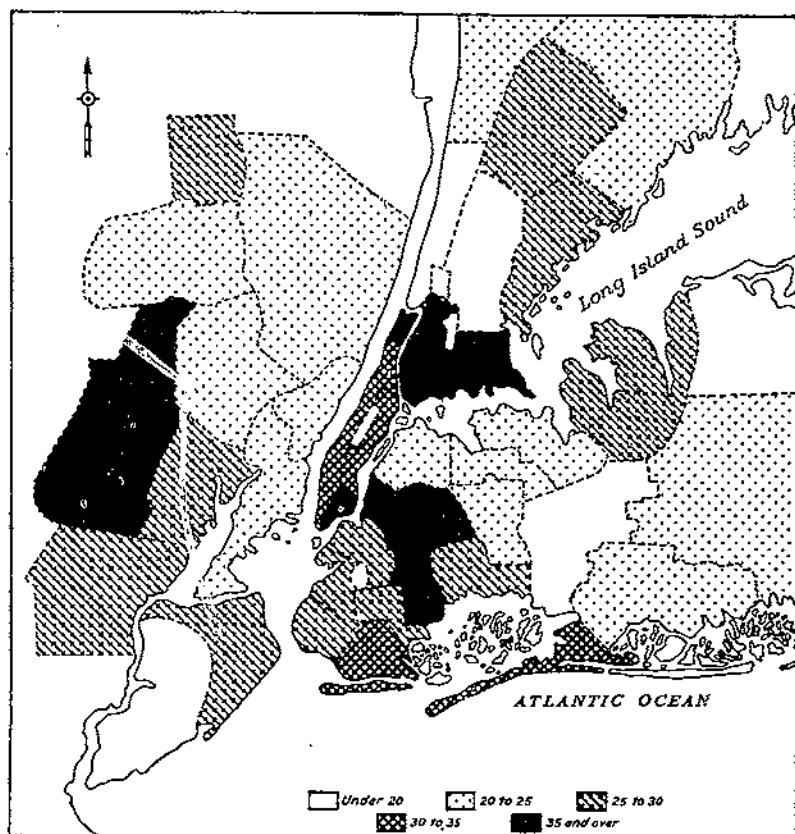


FIG. 3.—SALES OF GRADE A MILK AS PERCENTAGES OF TOTAL RETAIL MILK SALES PER FAMILY, NEW YORK METROPOLITAN AREA, 1924

Grade A milk sales vary widely with the economic condition of the people, the milk ordinances of the various municipalities, and the amount of dipped milk sold from stores

grade B milk. This product constituted as high as 79.4 per cent of the total retail sales in one of the Westchester County districts and was at least 65 per cent of the total in 24 of the 42 districts studied. In only two districts did it fall below 50 per cent. One of these districts held down the sale of grade B milk by its health regulations, and the other had a large store trade in dipped milk which replaced some of the retail sales of grade B milk.

TABLE 7.—Relative quantities of milk sold at retail in the New York metropolitan area, 1924

District	Percentage of the total sales for each district				
	Quarts of grade B milk	Quarts of grade A milk	Quarts of certified milk	Pints of grade B milk	Total
Manhattan:	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
1.....	42.3	48.8	1.2	7.7	100
2.....	56.9	32.0	1.4	9.7	100
3.....	56.8	33.8	2.1	7.3	100
4.....	61.9	33.3	1.3	3.5	100
5.....	59.2	33.4	2.6	4.8	100
Bronx:					
6.....	59.1	37.4	1.2	2.3	100
7.....	59.9	36.2	1.5	2.4	100
8.....	59.2	35.9	2.3	2.6	100
Brooklyn:					
9.....	64.9	29.2	2.7	3.2	100
10.....	61.3	33.0	3.0	2.7	100
11.....	67.4	26.6	2.3	3.8	100
12.....	63.2	28.6	4.7	3.5	100
13.....	64.5	28.9	2.9	5.7	100
14.....	53.4	42.3	2.1	2.2	100
15.....	68.9	26.6	2.6	2.5	100
16.....	59.7	35.7	1.8	2.8	100
Queens:					
17.....	71.0	23.2	2.9	2.9	100
18.....	69.9	23.4	1.4	5.3	100
19.....	71.7	22.8	2.0	3.5	100
20.....	69.9	23.1	4.0	3.0	100
21.....	75.5	19.9	2.1	2.5	100
22.....	62.6	32.0	3.5	1.9	100
Statens Island: 23.....	66.6	29.1	2.1	2.3	100
Long Island:					
24.....	71.8	23.0	3.2	2.0	100
25.....	68.7	22.3	5.4	3.6	100
26.....	64.7	27.6	5.6	2.1	100
Westchester County:					
27.....	70.4	16.8	1.0	2.8	100
28.....	75.9	19.5	2.2	2.7	100
29.....	67.0	26.1	3.7	3.2	100
30.....	70.8	22.7	3.3	3.2	100
31.....	65.8	27.9	4.5	1.8	100
32.....	70.9	24.0	2.8	2.3	100
New Jersey:					
33.....	65.0	29.0	1.6	3.4	100
34.....	57.9	37.5	1.5	3.1	100
35.....	66.1	28.4	1.4	4.1	100
36.....	68.9	24.9	2.1	4.1	100
37.....	27.4	67.7	3.5	1.4	100
38.....	73.9	21.0	2.0	2.5	100
39.....	67.0	34.7	5.6	2.7	100
40.....	72.9	23.3	1.4	2.4	100
41.....	60.6	24.7	2.0	2.8	100
42.....	67.2	26.9	3.6	2.3	100
Weighted average.....	63.1	31.0	2.3	3.6	100

The largest percentage of grade A milk (67.7 per cent) was found in one of the New Jersey districts which included the town of Montclair. No grade B milk could be sold for drinking purposes in that town, and the percentage of grade A sales was thereby raised for the entire district. Oddly enough, the district with the next highest percentage of grade A sales was the lower east side of Manhattan, which includes the poorest part of the city. Here the percentage of grade A sales appears to be high because the retail sales of grade B quarts were lowered by the purchases of dipped milk from stores. In other words, it seems likely that even the poorer families desire the higher-quality milk for their children, and if bottled milk is purchased a large part of it will be grade A.

Since certified milk retails at decidedly higher prices, and is used almost entirely for infants and invalids, it constituted only a small proportion of the total sales. Even in the better-class residential districts the maximum was only 5.6 per cent of the total sales. In general, the suburban districts offer a better market for this grade of milk than do the more densely populated areas.

Grade B pint sales also constituted a very small proportion of the demand in all but the business districts. Except in the lower half of

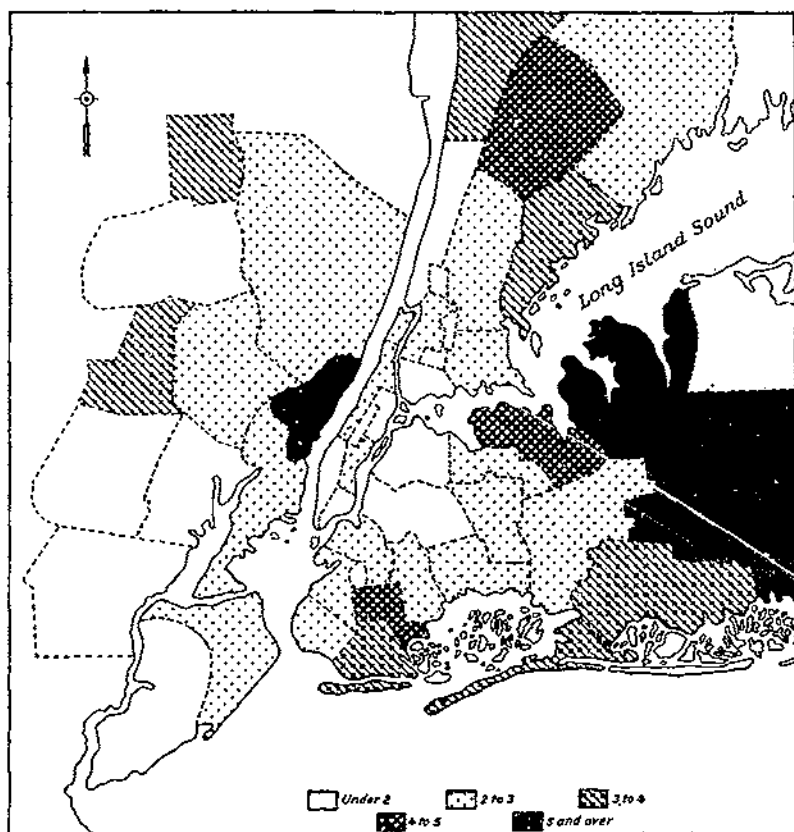


FIG. 4.—SALES OF CERTIFIED MILK AS PERCENTAGES OF TOTAL RETAIL MILK SALES PER FAMILY, NEW YORK METROPOLITAN AREA, 1924

Good suburban residential districts offer excellent facilities for the rearing of babies and the sale of certified milk

Manhattan and in one section of Brooklyn and one of Queens, the pint sales were less than 5 per cent of the total.

The average daily retail sales of cream per family for the entire metropolitan area amounted to only 0.064 half pint. (Table 6 and fig. 5.) This is approximately equivalent to the purchase of a half pint each day by one out of each 16 families, or the purchase of one bottle each week by one-half of all the families in the market. The variation in sales among the districts is, of course, far greater in the case of a semiluxury like cream than in the case of the more necessary

product, milk. The economic status of the consumers in the various districts also appears to be a more important factor in cream sales. The White Plains district in Westchester County led in the demand for cream as well as in the demand for milk. The average sales per family in this district were eleven times as great as in the lower east side of Manhattan. There was also considerable variation in the proportion of extra-heavy cream and light cream sold in the different

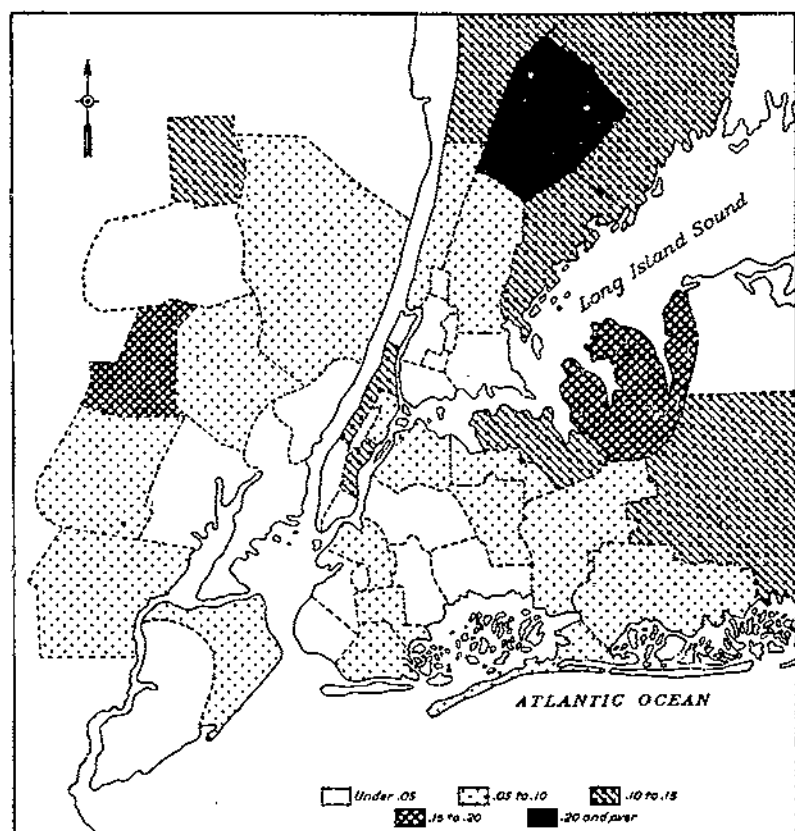


FIG. 5.—AVERAGE DAILY RETAIL SALES OF HALF PINTS OF CREAM PER FAMILY, NEW YORK METROPOLITAN AREA, 1924

Cream sales appear to be more influenced by the wealth of the consumers than milk sales

districts. The ratio of the high-test cream to the low-test cream ranged from 2 to 1 to 14 to 1.

The average retail sales of all bottled milk per family in 1924 were 7.4 per cent higher than in 1921. (Table 8.) The per capita receipts of all milk at this market in 1924, however, were 8.9 per cent higher, indicating that the wholesale sales (including some whole milk for ice cream) increased a little faster than did the retail sales. The changes in the respective districts showed great variation. A few regions showed decreases, but in the others the increases ranged from approximately 1 to 23 per cent. In general, the increase was greatest in the regions which had the lowest sales per family. This



may be attributed, in part, to the fact that the greater buying power which came with increased industrial prosperity permitted residents of these districts to increase their consumption of dairy products, whereas the wants of the residents in the wealthier districts were already filled.

TABLE 8.—Changes in the retail sales of milk and cream per family in the New York metropolitan area from 1921 to 1924

District	Changes in sales of—				
	Quarts of grade B milk	Quarts of grade A milk	Quarts of certified milk	All bottled milk	All bottled cream
<b>Manhattan:</b>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
1.....	+6.2	+22.5	-34.0	+9.0	+5.6
2.....	+10.8	+42.8	-14.3	+16.6	+50.3
3.....	+7.0	+31.2	-36.6	+9.6	+25.0
4.....	+1.5	+24.4	-25.6	+4.6	+6.8
5.....	+7.1	+41.0	-17.6	+12.4	-10.7
<b>Bronx:</b>					
6.....	+1.6	+20.5	-36.0	+7.3	-13.0
7.....	+0.2	+19.8	-13.0	+10.4	-0.9
<b>Brooklyn:</b>					
8.....	+8	+49.4	-2.9	+9.4	-2.0
9.....	+0.6	+41.8	+6.5	+14.3	+21.5
10.....	-2.5	+53.5	+3.1	+5.5	+17.9
11.....	-4	+44.1	0	+12.6	+20.8
12.....	+1.0	+21.3	-19.7	+5.3	-9.0
<b>Queens:</b>					
13.....	+5	+19.6	-24.4	+2.1	+20.2
14.....	+5.2	+22.7	0	+7.7	+59.3
15.....	+4.4	+42.8	-10.3	+8.5	-10.6
16.....	-13.2	+30.6	-23.3	-4.2	-4.2
17.....	-14.9	-3.2	-45.9	-14.0	-29.0
<b>Staten Island: 23.</b>					
18.....	-6.5	+22.1	-28.0	-2.8	0
19.....	-1.8	+32.0	-38.6	+9.3	+18.3
<b>Long Island:</b>					
20.....	+14.6	+19.3	-21.1	+12.7	+7.1
21.....	+2.1	+30.7	-22.5	+5.5	+27.0
22.....	-3	+28.7	-12.7	+3.4	+22.3
23.....	+5.1	+24.5	-12.5	+6.2	+17.3
24.....	+1.4	+31.5	-7.9	+0.5	+7.6
25.....	-5.6	+18.0	+34.5	-1.1	-28.1
<b>New Jersey:</b>					
26.....	+10.6	+40.4	-25.0	+15.6	+32.3
27.....	-2.0	+23.2	+38.5	+5.7	+44.0
28.....	-4.1	+28.8	-15.8	+1.4	+21.7
29.....	+0.6	+28.4	+26.3	+8.0	+43.2
30.....	+1.8	+38.1	+9.1	+8.1	+25.0
31.....	+1.2	+41.8	+54.8	+8.8	+57.4
32.....	+20.1	+50.3	0	+22.8	+40.1
33.....	-1.7	+24.0	+25.0	+2.8	+15.0
34.....	-10.4	+50.2	+25.7	+1.4	+23.1
<b>Weighted average.....</b>	<b>+2.4</b>	<b>+31.5</b>	<b>-6.2</b>	<b>+7.4</b>	<b>+13.5</b>

† Increases and decreases are expressed as percentages of the 1921 sales.

Retail sales of cream per family increased 13.5 per cent during the same period, as compared with an increase of 17.5 per cent in the per capita receipts of cream and condensed milk. Since the latter products play a much more important part in the manufacture of ice cream in the city, it is to be expected that the rapid rise in the consumption of that commodity would cause the receipts at the market to increase faster than did the retail sales of cream. The variation in the changes in sales among the districts is much greater in the case of cream than in the case of milk. The range is from a decrease of 29 per cent to an increase of 67.4 per cent. Cream sales also appear to have shown the greatest increases in districts with a low per family demand and a none too high buying power.

Perhaps the most significant feature of these changes in demand is the difference in the degree to which various grades of milk are affected. The rapid increase in population has resulted in an increased total demand for almost all dairy products, although the demand for some products has obviously increased more rapidly than that for others. The data show, however, that the per family sales of certified milk actually decreased 6.2 per cent during these years. Grade A milk sales per family, on the other hand, increased 31.5 per cent, while sales of quarts of grade B milk increased only 2.4 per cent. In other words, there was a notable shift from grade B and certified milk to grade A during the three-year period. The increases in sales per family of the last-named product amounted to over 50 per cent in several districts. It is evident that, with the present industrial prosperity, consumers do not consider the 3-cent margin between grade A and grade B milk too high. Certified-milk sales showed marked increases in a few of the New Jersey districts, particularly in regions to which many families have moved who wish

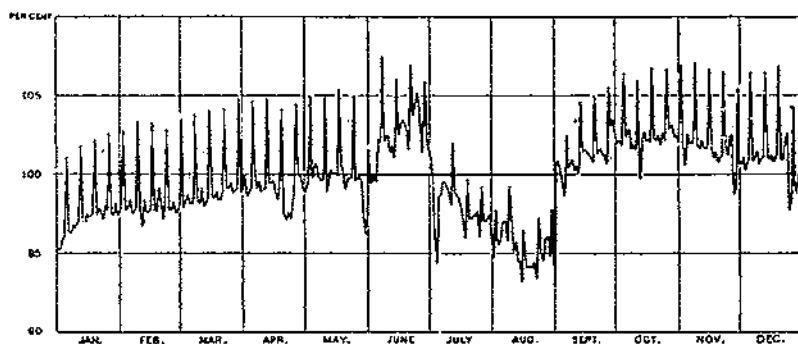


FIG. 6.—DAILY RETAIL SALES OF QUARTS OF GRADE B MILK BY ONE DEALER, NEW YORK, 1924

Sales expressed as percentages of the average for the year. Although the demand for this product is less variable than for most, the many types of fluctuations result in a very uneven sales curve

to rear their children outside of Manhattan and the other congested parts of the city.

#### TYPES OF VARIATION IN DEMAND

Sales variations may be classed in two general groups: (1) Regular or recurring variations and (2) irregular or intermittent fluctuations. Those in the first group might be termed calendar variations because they include long-time trends, seasonal variation, day-of-the-week variation, and holiday fluctuations. Since the exact time at which any one of these variations will occur is known, rather accurate estimates of the demand can be made, long in advance of the date, if quantitative measures are once established.

The second group of fluctuations are caused by highly variable factors such as temperature, industrial conditions, and price changes. Some of these factors affect sales only after a period of time, and changes in demand may be predicted some time in advance of their occurrence. Other factors, such as temperature, fluctuate over short periods and have an almost immediate effect on sales.

With all these factors operating at the same time, a very irregular demand naturally results. In analyzing these sales records, it is necessary to study one type of variation at a time, after having eliminated all the other factors. The effect of any one factor (for example, season) is therefore shown as a smooth curve since other variables have been eliminated. The combined effect of all factors gives the highly irregular sales curve familiar to milk dealers. In Figure 6 are shown the daily retail sales of quarts of grade B milk by one dealer during 1924. Although sales of this product are less variable than sales of most other dairy products handled by distributors, the fluctuations are pronounced.

### LONG-TIME TREND IN DEMAND

Since all but a small part of New York's milk and cream supply arrives by rail, an approximation of the trend in the total demand for milk may be obtained from the records of receipts which have been compiled monthly for many years by the Milk Reporter. Previous to January 1, 1927, these figures were given for milk, and for cream and condensed milk combined. Since that time, the Bureau of Agricultural Economics of the United States Department of Agriculture has been issuing daily, weekly, and monthly reports which show separately the receipts of milk, cream, and condensed milk. The average daily receipts of these three commodities for the first six months of 1927 are given in Table 9. In addition to the milk and cream consumed in fluid form, the figures probably include some milk, cream, and plain condensed milk used in the manufacture of ice cream and such other products as are made in the city. They also include a small amount of unsold surplus, which is usually made into butter.

TABLE 9.—Average daily receipts of milk, cream, and condensed milk in the New York metropolitan area during the first six months of 1927<sup>1</sup>

Month	Milk	Cream	Condensed milk	Total
	40-quart cans	40-quart cans	40-quart cans	40-quart cans
January.....	85,805	2,983	558	87,430
February.....	88,063	3,451	731	92,245
March.....	92,551	4,194	903	97,738
April.....	92,833	4,586	1,184	98,603
May.....	96,232	5,896	1,461	103,589
June.....	98,451	6,220	2,161	106,832
Average.....	91,971	4,555	1,181	97,707

<sup>1</sup> From Market News Service, Bureau of Agricultural Economics, United States Department of Agriculture. These data are presented here, because no previous figures are available showing the distribution of cream and condensed milk receipts, which were formerly published as one figure.

The receipts of milk and cream at New York have shown an almost constant increase since 1885, when these records were first made available.<sup>4</sup> This is accounted for by the steady growth of population and by the increased per capita consumption. The relation of these two factors and their effect on total receipts during the 15-year period 1912 to 1926, are shown in Figures 7 and 8.

<sup>4</sup> NORTON, L. J., and SPENCER, L. A PRELIMINARY SURVEY OF MILK MARKETING IN NEW YORK. N. Y. Cornell Agr. Exptl. Sta. Bul. 445: 4, illus. 1925.

Both the population and the per capita consumption of milk (as measured by receipts) increased at about the same rate from 1912 to 1918; but from then until 1926 the latter has been relatively higher.

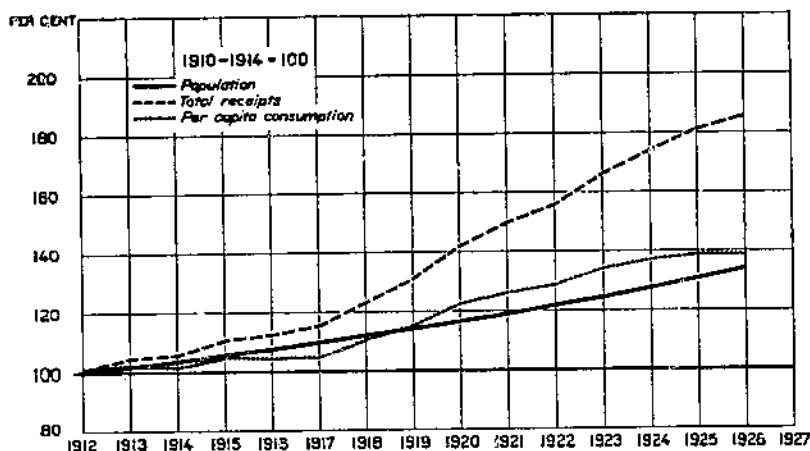


FIG. 7.—DEMAND FOR MILK, NEW YORK METROPOLITAN AREA, 1912-1926

All curves expressed as percentages of the 1910-1914 average. Steadily increasing population and per capita consumption require more and more milk shipped to this market each year.

The combined effect of these two factors has been to send the total receipts of milk in 1926 to 185 per cent of the 1910-1914 average. The per capita consumption of milk in 1926 was 139 quarts, or 39

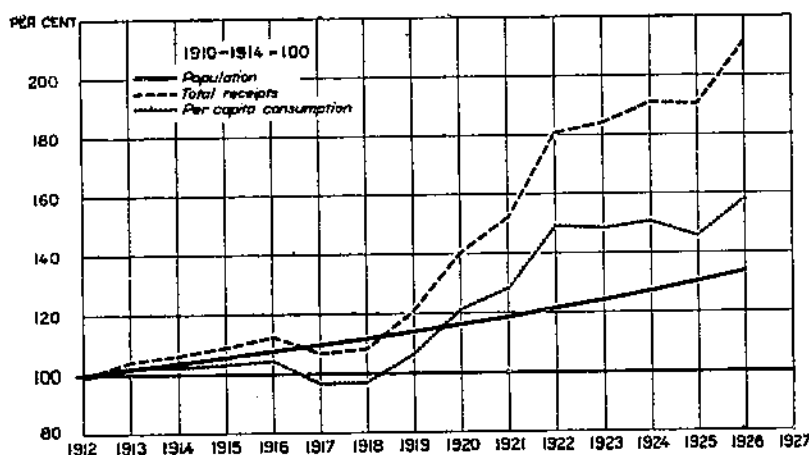


FIG. 8.—DEMAND FOR CREAM AND CONDENSED MILK, NEW YORK METROPOLITAN AREA, 1912-1926

All curves expressed as percentages of the 1910-1914 average. Industrial prosperity and the increased use of ice cream have caused these receipts at New York to rise more rapidly than the milk receipts.

per cent higher than during the base period, when it was approximately 100 quarts.

The per capita consumption of cream and condensed milk (including that shipped to the city for the manufacture of ice cream) rose

most rapidly from 1918 to 1922.<sup>5</sup> Following 1922 the per capita consumption has remained about stationary except for a slight rise in 1926. The increasing population, however, has resulted in a continuous rise in the total receipts, which in 1926 were more than double those in the 1910-1914 period. The per capita consumption of cream in that year was 8.4 quarts, or 158 per cent of the base.

In both of these charts the per capita consumption is based on estimated population between the census years, and their accuracy depends upon the accuracy of the projected curve of population. Of greater significance than the per capita consumption, is the trend of total demand. This is still tending steadily upward for both milk and cream, although at a decreasing rate. If the present industrial prosperity continues, and if the proper educational work on the dietary value of milk is carried on, this trend may be expected to continue for some time. During the five years 1922 to 1926, the New York market increased its average daily demand for milk, cream, and condensed milk at the rate of approximately 5.3 per cent each year, or the equivalent of 54,000 gallons of milk.

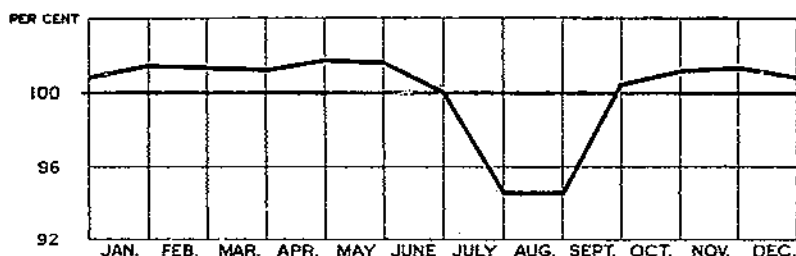


FIG. 9.—SEASONAL VARIATION IN THE NUMBER OF ACTIVE CUSTOMERS OF RETAIL MILK DRIVERS, NEW YORK METROPOLITAN AREA, 1921-1924

Number of customers at the end of each month expressed as percentages of the average for the year. More people leave the city during the vacation period than is indicated by the decrease in the number of families buying milk.

#### CAUSES OF SEASONAL VARIATIONS IN DEMAND

Seasonal variations in sales of milk are caused chiefly by two factors—the annual vacation migration, and the major temperature changes of the passing seasons. These two factors act in opposition, since both the per capita consumption of milk and the number of persons going on vacations increase as midsummer approaches. A measure of the vacation movement of the population may be gained from the retail route books of the milk drivers. One of the large distributing companies makes a practice of tabulating the number of active accounts of customers that are transferred at the end of the month from the old route book to the new. This gives accurate monthly data on the changes in the number of families in the various districts and in the entire metropolitan area. These figures, however, do not adequately take account of the one or two week vacations that may fall between two dates of enumeration. Nor do they show any decrease if some members of a family leave the city while others remain and continue to buy milk. The actual movement of retail customers during the vacation season is therefore greater than these monthly data indicate.

<sup>5</sup> From unpublished data computed by Leland Spencer.

The percentage variation in the number of families being served by retail wagons in the New York metropolitan area is shown in Figure 9. It should be remembered that these enumerations are made only once each month, and that the lines connecting the plotted points do not necessarily follow the population movements between these dates. The number of families buying milk on the last of July and the last of August is more than 6 per cent below that for the rest of the year.

Producers of milk for the New York market are fortunate in that a number of summer-resort regions are included in the metropolitan

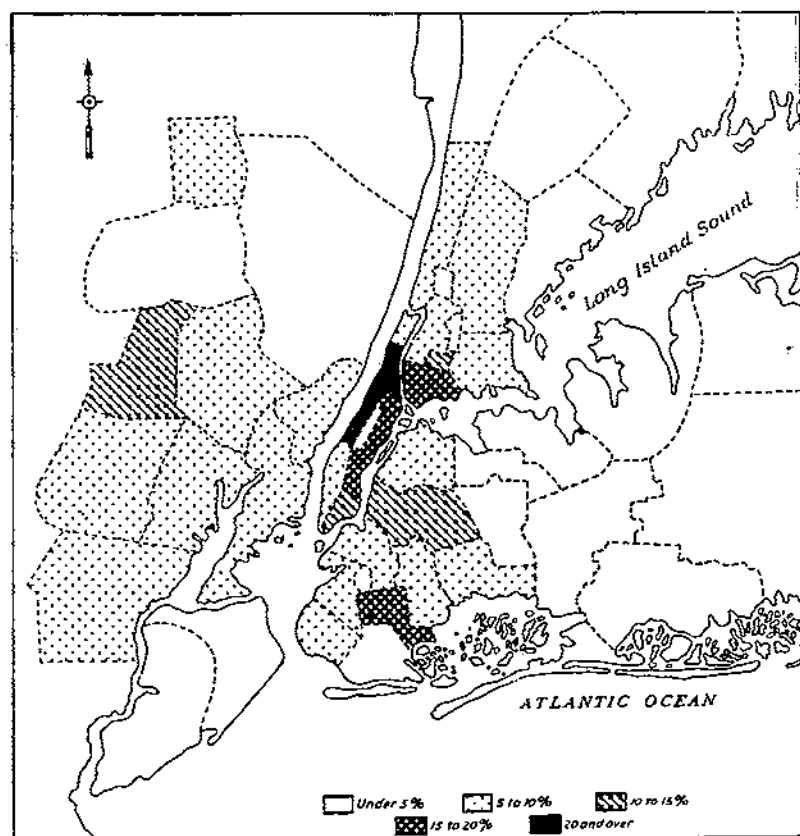


FIG. 10.—DECREASE IN NUMBER OF FAMILIES BUYING MILK FROM RETAIL WAGONS, NEW YORK METROPOLITAN AREA, JULY AND AUGUST, 1923-1924

Decreases in the number of families expressed as percentages of the May and October average. In some of the wealthier districts the decrease may amount to one-fourth of the customers.

area served by the regular milk dealers. The movement of people from their homes to cottages or hotels along the neighboring beaches may cause trouble for the milk distributors, but it does not deprive producers of a market for their milk. The vacation movement to more distant summer resorts, however, decreases the demand in this city market. If the summer resort is in the New York milk shed, it may merely mean that a producer ships his milk to the city in the winter and sells it locally to New Yorkers in the summer.

The vacation change in population in each of the 42 districts is shown in Table 10 and in Figures 10 and 11. The vacation movement for the entire area in 1923 and 1924 was almost double what it was in 1919 and 1920. This tendency for more and more persons to go away on their vacations is also shown by most of the individual districts. There is much to support the belief that this trend will continue as long as the industrial prosperity of the city is maintained.

The greatest movement out of the district is found in the section west of Central Park (district 5). One-fourth of the retail customers

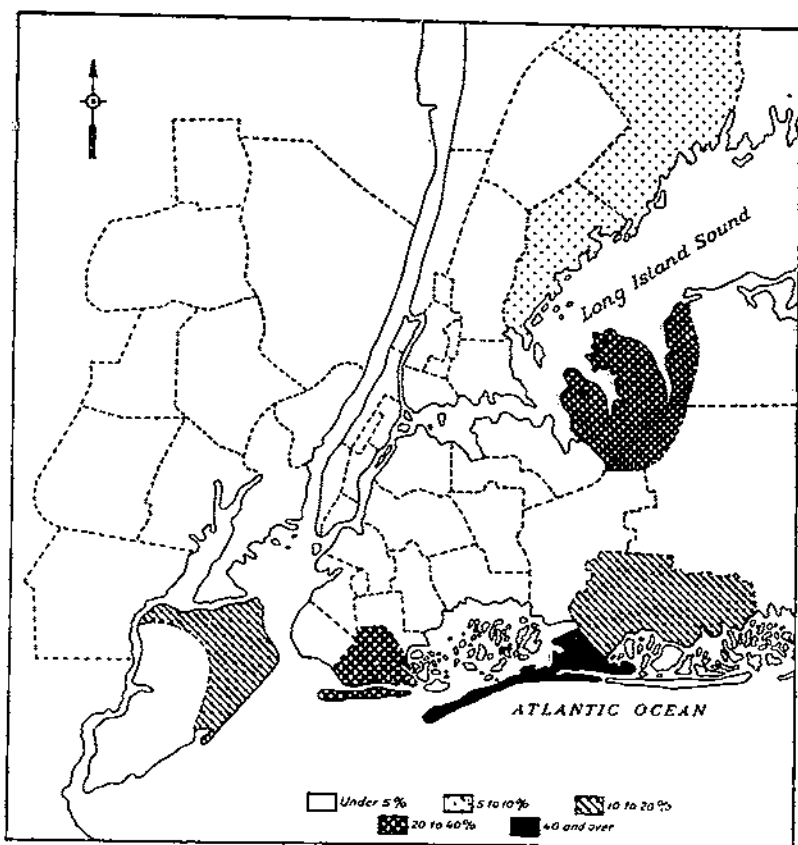


FIG. 11.—INCREASE IN NUMBER OF FAMILIES BUYING MILK FROM RETAIL WAGONS, NEW YORK METROPOLITAN AREA, JULY AND AUGUST, 1923-1924

Increases in the number of families expressed as percentages of the May and October average. Because of the near-by beaches, certain districts may double their population during the vacation months.

in this section discontinue service during the two hottest months. It is highly probable that the majority of these leave the metropolitan area. In some of the other districts, the bulk of the movement is probably to Brighton, Manhattan, and Rockaway Beaches, or similar resort sections. The population in such resort sections is naturally very much higher in July and August than during the rest of the year. In district 22, which includes the various Rockaway beaches, the number of retail customers more than doubles during the two hottest months.

TABLE 10.—Movements of retail customers into and out of districts in the New York metropolitan area during July and August

District	Changes in the number of customers during July and August expressed as percentages of the average for May and October—		District	Changes in the number of customers during July and August expressed as percentages of the average for May and October—	
	1919 and 1920	1920 and 1923		1919 and 1920	1923 and 1924
Manhattan:	Per cent	Per cent	Staten Island: 23.....	Per cent	Per cent
1.....	-7.0	-13.8	Long Island:	+19.4	+15.4
2.....	-1.0	-6.8	24.....	+12.2	+17.0
3.....	-19.4	-17.0	25.....	+9.8	+4.1
4.....	-14.8	-15.0	26.....	(1)	+29.0
5.....	-22.1	-21.6	Westchester County:		
Bronx:			27.....	-4.7	-5.2
6.....	-14.8	-19.9	28.....	-8.6	-5.3
7.....	(1)	-14.6	29.....	-1.4	+6.6
8.....	-2.6	-9.6	30.....	+2.4	-1.4
Brooklyn:			31.....	-7.4	-3.0
9.....	-4.0	-5.6	32.....	+8.5	+7.0
10.....	+33.9	+20.6	New Jersey:		
11.....	(1)	-7.5	33.....	-3.2	-6.8
12.....	-8.3	-10.2	34.....	-3.5	-9.4
13.....	-12.7	-5.8	35.....	+2.0	-7.6
14.....	+4	-6.8	36.....	+5.0	-8.8
15.....	(1)	-6.1	37.....	+1.1	-13.3
16.....	-15.8	-13.1	38.....	+1.8	-6.2
Queens:			39.....	-4.0	-8.4
17.....	-3.4	-3.2	40.....	-1	-3.6
18.....	+6	-7.4	41.....	-3.2	+2.8
19.....	(1)	+1.1	42.....	-6	-7.0
20.....	-4	-1	Weighted average.....	-3.4	-6.2
21.....	(1)	-1.7			
22.....	+79.2	+114.3			

1 Data not available.

2 1924 only.

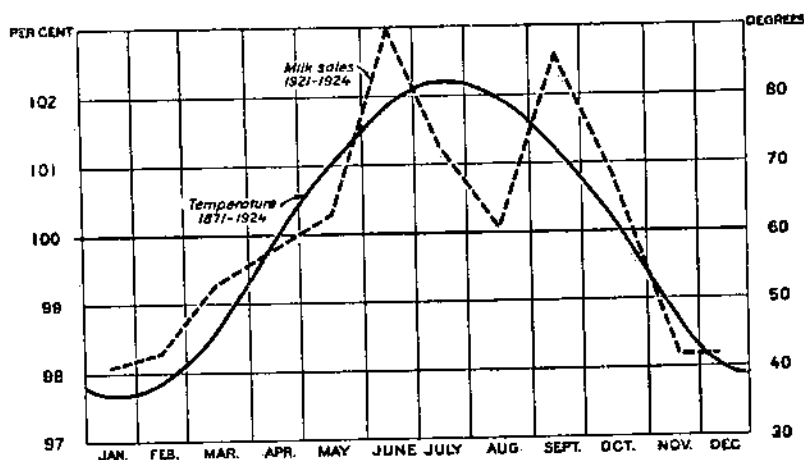


FIG. 12.—SEASONAL VARIATION IN TEMPERATURE AND IN RETAIL SALES OF MILK PER FAMILY, NEW YORK METROPOLITAN AREA

Weekly average of maximum temperatures, 1871-1924, shown in degrees, and monthly sales, 1921-1924, expressed as percentages of the average for the year. Sales per family rise with the temperature except during the vacation period, when several factors result in a faulty measure

The effect of seasonal temperature changes on the demand for milk is indicated to some extent by Figure 12. The temperature curve is



based on the average maximum temperature during the 54-year period from 1871 to 1924. Maximum rather than mean temperatures are used, because the former ordinarily are attained in the daytime when milk consumption would be affected.

The retail sales per family were obtained by dividing the average daily sales for the month by the average number of customers at the beginning and at the end of the month. The sales rise approximately 5 per cent from the low point in January, to June. They do not continue to rise with the temperature through July, but actually fall during the next two months. Several explanations of this decrease might be suggested.

1. The wealthier families, particularly if they have children, are most likely to leave the city, thus decreasing the number of heavy consumers.
2. The monthly enumeration of customers does not show the loss in sales which is due to short vacation trips of one or two weeks.
3. No account is taken of the loss of customers if only a part of the family goes on a vacation.
4. Week-end trips are most common during July and August.

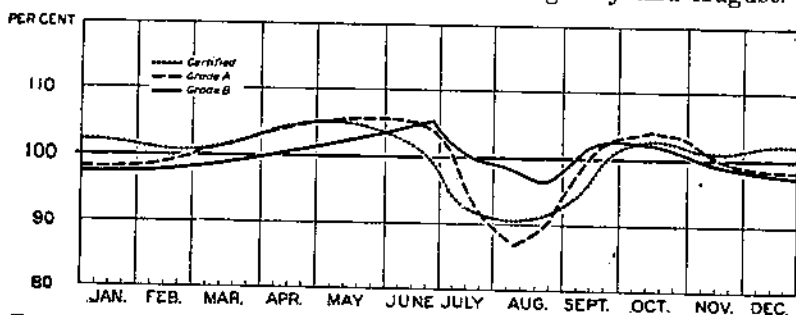


FIG. 13.—SEASONAL VARIATION IN RETAIL SALES OF QUARTS OF BOTTLED MILK NEW YORK METROPOLITAN AREA, 1919-1924

Weekly sales expressed as percentages of the average for the year as shown by smooth curves. The vacation decrease in demand is greater for those grades of milk consumed largely by children not of school age and by people who can well afford a vacation.

If records showing sales to identical families throughout the year were available, there is no doubt but that the demand per family would increase to the latter part of July and then decrease to December. Such a trend is shown by these data, except for the two vacation months.

#### SEASONAL VARIATION IN RETAIL SALES

The net effect of the vacation migration and the seasonal temperature changes varies with different commodities. (Tables 11 and 12.) Retail sales of quarts of grade B milk increase slowly with the increasing temperature and reach a peak late in June. (Fig. 13.) The temperature, of course, continues to rise, but schools close at this time, and the vacation migration causes an abrupt drop in demand. During July and August there is a continual movement of people to and from the city, but the out-of-city movement is the heavier, and sales continue to decline until the last of August. With the opening of schools, the cityward movement of population sends demand sharply upward. This trend continues until about the 1st of October, by which time practically all vacationists have returned, and the cold weather causes a falling off in demand.

TABLE 11.—Seasonal variation in the retail sales of milk in the New York metropolitan area, 1919-1924<sup>1</sup>

Month and week	Percentage of average for the year				Month and week	Percentage of average for the year			
	Quarts of grade B milk	Quarts of grade A milk	Quarts of certified milk	Pints of grade B milk		Quarts of grade B milk	Quarts of grade A milk	Quarts of certified milk	Pints of grade B milk
January:	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	July:	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
First.....	97.5	98.2	102.0	93.6	First.....	102.5	101.6	95.6	100.3
Second.....	97.5	98.2	101.9	92.4	Second.....	101.0	97.5	93.0	100.0
Third.....	97.5	98.3	101.8	91.8	Third.....	100.0	93.3	91.0	100.0
Fourth.....	97.0	98.4	101.5	91.5	Fourth.....	99.4	90.4	91.2	100.0
February:					August:				
First.....	97.7	98.6	101.1	91.2	First.....	98.0	88.5	90.8	108.3
Second.....	97.8	98.9	100.8	91.1	Second.....	98.1	86.0	90.7	106.5
Third.....	97.9	99.3	102.7	91.0	Third.....	97.3	88.0	90.9	105.2
Fourth.....	98.2	99.8	100.0	91.1	Fourth.....	96.4	89.6	91.3	104.2
March:					Fifth.....	97.4	92.4	92.2	103.4
First.....	98.4	100.4	100.7	91.3	September:				
Second.....	98.7	101.0	100.0	91.7	First.....	99.4	90.1	93.5	103.0
Third.....	99.0	101.5	101.3	92.2	Second.....	101.2	99.1	95.0	102.7
Fourth.....	99.3	102.0	101.9	92.8	Third.....	101.9	101.3	98.4	102.5
Fifth.....	99.6	102.5	102.6	93.9	Fourth.....	102.3	102.5	100.6	102.4
April:					October:				
First.....	99.9	103.2	103.4	95.1	First.....	102.3	103.2	101.7	102.3
Second.....	100.2	103.7	104.0	96.3	Second.....	102.1	103.6	102.2	102.0
Third.....	100.5	104.2	104.5	97.5	Third.....	101.8	103.0	102.5	101.6
Fourth.....	100.9	104.6	104.8	98.8	Fourth.....	101.4	103.5	102.3	101.3
May:					Fifth.....	100.7	103.1	101.0	100.8
First.....	101.3	105.0	105.0	100.1	November:				
Second.....	101.7	105.3	105.0	101.5	First.....	100.1	101.9	101.3	100.2
Third.....	102.1	105.6	104.8	102.9	Second.....	99.5	100.7	100.0	99.5
Fourth.....	102.6	105.6	104.4	104.5	Third.....	99.1	99.9	100.8	98.7
Fifth.....	103.1	105.6	103.8	106.1	Fourth.....	98.7	99.3	100.9	97.8
June:					December:				
First.....	103.6	105.6	103.1	107.8	First.....	98.4	98.9	101.4	96.8
Second.....	104.1	105.3	102.1	109.8	Second.....	98.0	98.6	101.8	95.8
Third.....	104.7	104.7	100.9	111.1	Third.....	97.8	98.5	102.0	94.8
Fourth.....	105.3	103.7	99.0	112.5	Fourth.....	97.6	98.4	102.0	93.9
					Average.....	100.0	100.0	100.0	100.0

<sup>1</sup> Nov. 1, 1921, to Oct. 31, 1922, omitted because of milk-drivers' strike which caused abnormal sales during the early part of that period.

TABLE 12.—Seasonal variation in the retail sales of miscellaneous dairy products in the New York metropolitan area, 1919-1924<sup>1</sup>

Month and week	Percentage of average for the year				
	Extra-heavy cream	Light cream	Condensed milk	Butter	Butter-milk
January:	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
First.....	96.8	103.4	100.4	88.4	64.3
Second.....	96.9	103.2	107.1	80.8	64.1
Third.....	97.1	103.1	107.5	92.6	64.4
Fourth.....	97.4	103.1	107.9	97.6	64.8
February:					
First.....	97.8	103.1	108.3	101.6	65.6
Second.....	98.4	103.1	108.7	103.9	65.5
Third.....	99.0	103.1	109.0	105.4	67.6
Fourth.....	99.6	103.2	109.3	106.8	69.0
March:					
First.....	100.2	103.3	109.5	107.6	70.7
Second.....	100.9	103.4	109.7	107.3	72.6
Third.....	101.7	103.5	109.9	109.5	75.1
Fourth.....	102.6	103.6	110.0	105.5	77.7
Fifth.....	103.5	103.7	110.1	104.5	80.5

<sup>1</sup> Nov. 1, 1921, to Oct. 31, 1922, omitted because of milk drivers' strike which caused abnormal sales during the early part of that period.

TABLE 12.—Seasonal variation in the retail sales of miscellaneous dairy products in the New York metropolitan area, 1919-1924—Continued

Month and week	Percentage of average for the year				
	Extra-heavy cream	Light cream	Condensed milk	Butter	Butter-milk
April:	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
First.....	104.4	103.9	110.2	103.2	83.6
Second.....	105.4	104.0	110.3	101.6	87.6
Third.....	106.5	104.3	110.4	100.6	91.7
Fourth.....	107.9	104.7	110.4	100.9	96.2
May:					
First.....	109.9	105.4	110.3	102.3	101.4
Second.....	112.7	106.4	110.3	104.1	107.2
Third.....	116.9	107.1	110.2	104.8	113.3
Fourth.....	119.8	107.3	109.7	104.8	120.2
Fifth.....	120.6	107.2	107.6	103.7	127.6
June:					
First.....	120.4	106.7	105.2	103.5	135.5
Second.....	119.4	105.5	102.2	104.0	146.0
Third.....	116.1	103.6	98.3	106.4	160.1
Fourth.....	110.1	100.0	94.1	100.1	182.5
July:					
First.....	100.0	96.0	88.8	98.9	177.6
Second.....	95.1	92.6	84.4	98.0	172.4
Third.....	91.5	90.0	80.6	97.4	169.9
Fourth.....	88.9	87.5	77.9	97.2	161.2
August:					
First.....	86.4	85.2	75.6	97.1	155.1
Second.....	84.4	83.3	74.2	97.3	147.7
Third.....	83.4	82.0	74.0	97.5	139.7
Fourth.....	83.4	81.6	74.9	98.1	131.5
Fifth.....	85.0	82.6	77.2	98.9	123.1
September:					
First.....	89.1	85.4	80.9	100.7	114.9
Second.....	92.7	90.8	86.0	104.3	107.0
Third.....	94.7	94.8	90.8	105.2	100.8
Fourth.....	96.1	97.0	94.3	105.3	95.0
October:					
First.....	97.1	99.0	97.0	104.7	90.1
Second.....	97.8	100.5	98.9	103.6	85.6
Third.....	98.3	101.7	100.3	102.3	82.0
Fourth.....	98.6	102.8	101.5	100.5	78.5
Fifth.....	98.6	103.5	102.3	98.6	76.6
November:					
First.....	98.3	104.0	103.0	96.8	72.8
Second.....	97.8	104.5	103.6	95.2	70.7
Third.....	97.3	104.7	104.1	93.9	68.8
Fourth.....	96.9	104.8	104.6	92.7	67.4
December:					
First.....	96.7	104.6	105.1	91.6	66.1
Second.....	96.6	104.4	105.5	90.7	65.0
Third.....	96.6	104.1	105.8	89.8	64.5
Fourth.....	96.7	103.7	106.1	89.2	64.4
Average.....	100.0	100.0	100.0	100.0	100.0

A somewhat similar seasonal variation is shown by the sales of quarts of grade A milk, although minor differences may be noted. (Fig. 13.) Sales fall off much more in the summer, and the low demand begins before schools close and continues after they have opened, because a larger proportion of grade A milk is consumed by children not yet of school age, and many families can leave on their vacations without waiting for the close of school. Similarly, they are under no necessity of returning for the opening of school.

Certified milk is consumed so largely by children under school age that, unless there are older children in the family, no attention need be paid to the opening or the closing of school. As a result, the vacation decrease covers a still longer period. Neither grade A nor certified milk shows the sharply marked changes in demand which characterize the vacation period in the case of grade B milk.

There is a slight increase in sales of certified milk in the coldest part of the winter, when sales would naturally be expected to decline. This appears to be due to a distinct seasonal variation in the number of births in New York. (Table 13 and fig. 14.) The number of births during January, February, and March is high. There is then a decline to a low point in May, followed by a secondary peak in July and another decline to December. With a normal period of nursing of 9 or 10 months, babies born in January, February, and March will be started on certified milk in November, December, and January. Since the births during the first three months are unusually high, the demand for certified milk goes up 9 or 10 months later. Many babies, of course, are started on cow's milk soon after birth. Others have their natural food supplemented with cow's milk when they are only four or five months old, but even these contribute to the demand when they stop nursing at the end of the

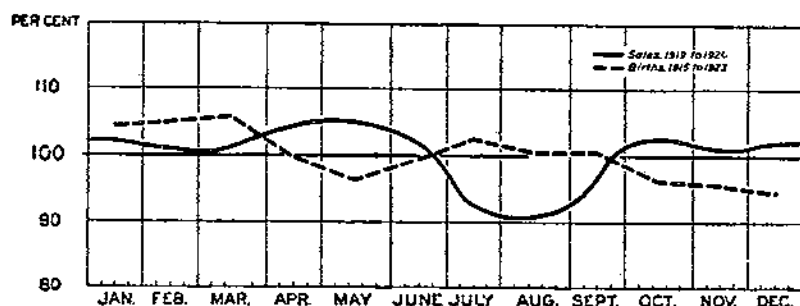


FIG. 14.—SEASONAL VARIATION IN THE NUMBER OF BIRTHS, 1915-1923, AND RETAIL SALES OF CERTIFIED MILK, 1915-1924, NEW YORK METROPOLITAN AREA

Monthly birth and weekly sales expressed as percentages of the average for the year as shown by smoothed curve. Seasonal variation in the number of babies born in New York introduces a third factor in the seasonal variation of certified milk.

longer period. The increase due to the July secondary peak in births is concealed in the larger increase due to rising temperature in April and May.

TABLE 13.—Seasonal variation in the number of births in the New York registration area

Month	8-year average of births <sup>1</sup>		Month	8-year average of births <sup>1</sup>	
	Number	Per cent		Number	Per cent
January.....	11,576	104.3	August.....	11,131	100.2
February.....	11,553	104.9	September.....	11,142	100.3
March.....	11,742	105.7	October.....	10,687	96.2
April.....	11,087	99.8	November.....	10,042	95.8
May.....	10,709	96.4	December.....	10,509	94.6
June.....	11,065	99.5	Average.....	11,109	100.0
July.....	11,304	102.3			

<sup>1</sup> 1915 to 1923, with August, 1918, to July, 1919, omitted because of influenza epidemic. Corrected for secular trend and adjusted to 30-day month.

Compiled from reports of the Bureau of the Census.

The sales of pints of grade B milk present a different picture, because a much greater proportion is consumed by adults.

(Fig. 15.) Temperature affects the adult demand for milk much more than it does the children's demand, because children do not shift from milk to tea or coffee as do adults. The drinking of milk with luncheons has much to do with the high summer demand. Working people who lunch down town consume large quantities of milk when

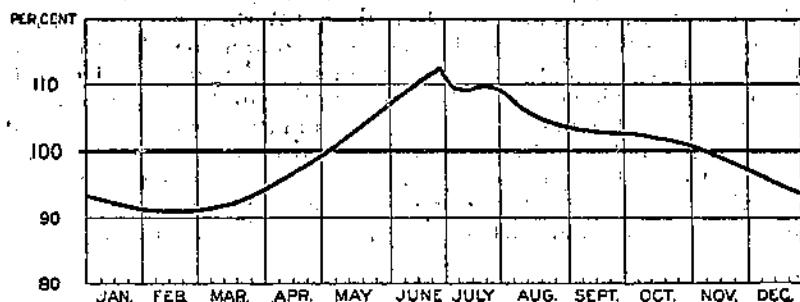


FIG. 15.—SEASONAL VARIATION IN THE RETAIL SALES OF PINTS OF GRADE B MILK, NEW YORK METROPOLITAN AREA, 1919-1924

Weekly sales expressed as percentages of the average for the year as shown by smoothed curves. The demand for pints increases in the summer because many adult workers shift from tea or coffee to milk during the hot weather.

the weather is hot, but when the weather is cold they change to a hot drink, and the demand for pints is therefore much greater in summer than in winter. Vacations tend merely to check the increase rather than to cause an actual decrease.

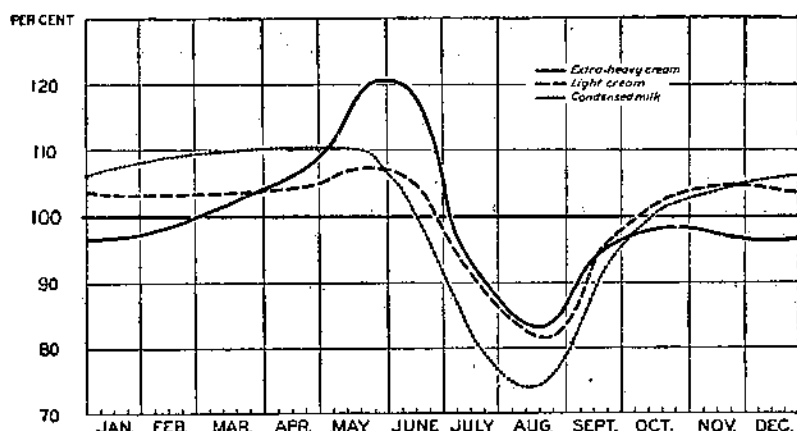


FIG. 16.—SEASONAL VARIATION IN RETAIL SALES OF CREAM AND CONDENSED MILK, NEW YORK METROPOLITAN AREA, 1919-1924

Weekly sales expressed as percentages of the average for the year as shown by smoothed curves. Extra heavy cream is in greatest demand during the berry season. Light cream and condensed milk are used largely for coffee and are in greatest demand during the winter.

Retail sales of extra-heavy cream (Fig. 16) reach their peak about the 1st of June, when fresh berries are on the market and before the vacation migration has begun. Sales at this time are more than 40 per cent higher than they are at the lowest point, in the latter part of August, when the maximum number of persons are out of the city. With the return of vacationists the sales of cream rise, but the

berry season is past, and the high point in the fall is 17 per cent below the early summer peak. Light cream, on the other hand, fails to show as high sales when berries are on the market. It is used in the home largely for coffee, and the demand is therefore high in winter and low during the hot weather. Condensed milk, the curve for which is shown in the same chart, is the unsweetened product sold in half-pint bottles and is used by some persons as a substitute for cream in coffee. The seasonal variations in the sales of condensed milk and light cream are therefore somewhat similar.

Buttermilk is a popular summer drink, since many persons consider the acid taste very refreshing during hot weather. Retail sales of this product reach a maximum about the last week in June, at which time the demand is almost three times as great as in the coldest months. (Fig. 17.)

Sales of butter on retail milk routes do not show as regular seasonal variations as do milk and cream sales because of the great variability

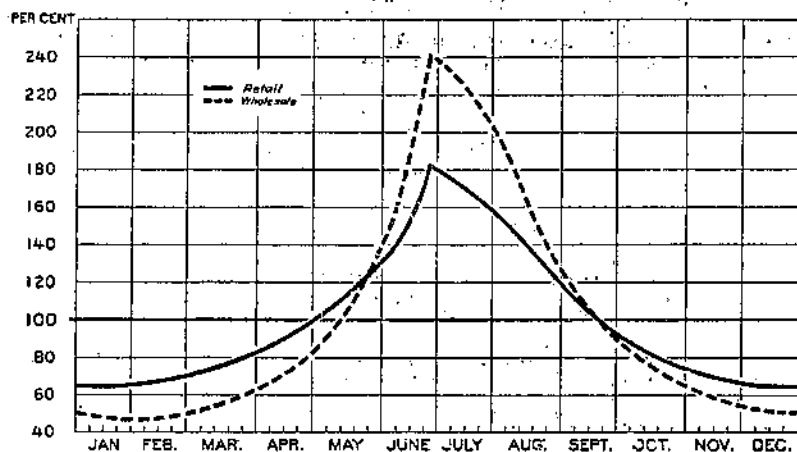


FIG. 17.—SEASONAL VARIATION IN SALES OF BUTTERMILK, NEW YORK METROPOLITAN AREA, 1919-1924

Weekly sales expressed as percentages of the average for the year as shown by smoothed curves. Note that the scale used here differs from that used in previous charts. Buttermilk is largely a hot-weather drink

in the price of butter. The effect of price changes is considered later. At present it is sufficient to say that the seasonal sales for any one year may vary widely from the average, depending upon whether butter prices follow the normal seasonal trend. In Figure 18 it is shown that, on the average, butter sales on milk routes are low during the season of high prices and during the vacation period.

#### SEASONAL VARIATION IN WHOLESALE SALES

The seasonal variation in wholesale sales differs from that in retail sales because a number of new factors of demand are introduced. The extent to which they differ may be noted by comparing Tables 14 and 15 and Figures 19 to 21, with those showing the corresponding retail sales. In addition to the bulk and bottled products sold to stores for resale to the consumer, large quantities of these products are sold to hotels, restaurants, stands, schools, hospitals, prisons, and

like places, where they are consumed on the spot instead of being taken into the home. Smaller quantities of milk, cream, and condensed milk are sold also at wholesale to confectionaries, where they are made into ice cream or served in various ways at the soda fountain.

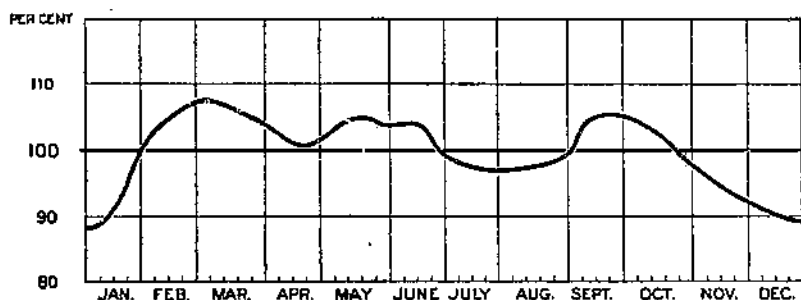


FIG. 18.—SEASONAL VARIATION IN RETAIL SALES OF BUTTER ON MILK ROUTES, NEW YORK METROPOLITAN AREA, 1919-1924

Weekly sales expressed as percentages of the average for the year as shown by smoothed curves. High winter prices, as well as the vacation period, cause a decrease in demand.

TABLE 14.—Seasonal variation in the wholesale sales of milk in the New York metropolitan area, 1920-1924<sup>1</sup>

Month and week	Percentage of average for the year				Month and week	Percentage of average for the year			
	Quarts of grade B milk	Quarts of grade A milk	Grade B bulk milk	Pints of grade B milk		Quarts of grade B milk	Quarts of grade A milk	Grade B bulk milk	Pints of grade B milk
January:	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	July:	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
First.....	81.8	89.8	80.7	78.0	First.....	123.6	112.7	118.5	129.7
Second.....	81.4	80.8	89.8	78.8	Second.....	128.1	110.8	116.5	128.6
Third.....	81.0	89.8	90.0	79.0	Third.....	131.7	109.5	114.6	126.7
Fourth.....	80.7	90.2	90.5	79.4	Fourth.....	133.8	108.7	112.7	124.8
February:					August:				
First.....	80.5	90.0	91.3	70.8	First.....	133.8	108.0	110.9	122.6
Second.....	80.7	91.3	92.3	80.6	Second.....	131.6	107.5	109.2	120.3
Third.....	81.0	92.6	93.3	81.6	Third.....	120.2	107.0	107.6	117.9
Fourth.....	81.6	94.0	94.2	82.0	Fourth.....	126.5	106.5	106.0	115.6
March:					Fifth.....	123.4	105.9	104.4	113.0
First.....	82.5	95.5	95.1	84.5	September:				
Second.....	83.5	97.0	96.0	86.1	First.....	120.0	105.2	102.9	110.4
Third.....	84.5	98.3	96.8	88.0	Second.....	116.7	104.4	101.5	107.6
Fourth.....	85.8	99.5	97.5	90.1	Third.....	113.4	103.4	100.3	104.8
Fifth.....	86.9	100.6	98.2	92.3	Fourth.....	109.7	102.2	99.2	101.8
April:					October:				
First.....	88.2	101.6	98.9	94.8	First.....	105.9	100.7	98.1	99.0
Second.....	89.7	102.2	99.6	97.4	Second.....	102.5	98.8	97.0	96.2
Third.....	91.3	102.8	100.2	100.3	Third.....	99.5	96.9	95.9	93.6
Fourth.....	93.1	103.2	100.8	103.3	Fourth.....	96.5	95.0	94.9	91.1
May:					Fifth.....	93.8	93.4	94.0	89.0
First.....	95.2	103.7	101.5	100.6	November:				
Second.....	97.7	104.2	102.4	109.9	First.....	91.5	92.0	93.1	86.9
Third.....	100.3	104.7	103.4	113.3	Second.....	89.4	91.1	92.3	85.0
Fourth.....	102.9	105.3	104.7	110.7	Third.....	87.5	90.3	91.6	83.5
Fifth.....	105.8	106.3	106.4	119.8	Fourth.....	85.9	89.8	91.0	82.1
June:					December:				
First.....	106.0	107.8	108.4	122.8	First.....	84.7	89.8	90.5	80.9
Second.....	112.3	110.2	111.1	125.6	Second.....	83.5	89.8	90.2	80.0
Third.....	115.9	113.3	114.7	128.1	Third.....	82.8	89.8	89.9	79.4
Fourth.....	119.7	116.7	120.7	130.0	Fourth.....	82.3	89.8	89.7	79.0
					Average.....	100.0	100.0	100.0	100.0

<sup>1</sup> Nov. 1, 1921, to Oct. 31, 1922, omitted because of milk-drivers' strike, which caused abnormal sales during the early part of that year.

TABLE 15.—Seasonal variation in the wholesale sales of miscellaneous dairy products in the New York metropolitan area, 1920-1924<sup>1</sup>

Month and week	Percentage of average for the year				Month and week	Percentage of average for the year			
	Extra-heavy cream	Light cream	Condensed milk	Butter-milk		Extra-heavy cream	Light cream	Condensed milk	Butter-milk
January:	Per cent	Per cent	Per cent	Per cent	July—Contd.	Per cent	Per cent	Per cent	Per cent
First.....	80.8	77.2	68.0	49.6	Third.....	115.8	137.6	147.3	210.0
Second.....	81.1	77.3	68.4	48.3	Fourth.....	112.8	131.0	145.0	208.8
Third.....	81.5	77.6	69.0	47.5	August:				
Fourth.....	82.1	78.0	69.9	47.0	First.....	110.1	125.4	142.1	196.7
February:					Second.....	107.4	119.8	139.3	181.8
First.....	82.8	78.9	71.1	46.7	Third.....	104.9	114.5	130.1	162.7
Second.....	84.1	80.1	72.6	46.9	Fourth.....	102.5	109.8	132.0	146.1
Third.....	85.5	81.2	74.4	47.6	Fifth.....	100.2	105.3	127.1	132.5
Fourth.....	87.1	81.6	70.3	48.8	September:				
March:					First.....	98.0	101.1	121.0	120.7
First.....	88.0	84.2	78.5	50.5	Second.....	95.9	97.4	112.6	110.3
Second.....	91.1	85.9	80.8	52.8	Third.....	94.2	94.0	102.9	100.7
Third.....	93.4	87.8	83.3	55.4	Fourth.....	92.6	91.0	96.2	93.0
Fourth.....	96.0	89.8	85.8	58.2	October:				
Fifth.....	99.0	91.0	88.6	61.4	First.....	91.0	88.3	90.5	86.1
April:					Second.....	89.3	85.9	85.9	80.2
First.....	102.2	94.3	91.7	64.0	Third.....	87.8	84.0	81.8	74.8
Second.....	105.8	97.3	95.1	66.6	Fourth.....	89.5	82.3	78.6	70.4
Third.....	109.5	100.4	98.8	73.3	Fifth.....	85.4	80.8	76.0	66.3
Fourth.....	113.5	103.7	102.7	79.9	November:				
May:					First.....	84.3	79.5	73.8	62.7
First.....	118.0	107.4	100.9	80.7	Second.....	83.3	78.5	71.9	59.6
Second.....	123.1	111.3	111.4	94.8	Third.....	82.2	77.8	70.4	57.0
Third.....	128.3	115.8	116.1	104.3	Fourth.....	81.3	77.2	68.0	54.6
Fourth.....	134.0	121.6	121.0	116.7	December:				
Fifth.....	140.1	127.1	126.2	131.0	First.....	80.8	76.8	68.1	52.0
June:					Second.....	80.4	76.5	67.6	51.5
First.....	139.2	133.5	131.9	148.9	Third.....	80.3	75.4	67.4	50.5
Second.....	132.5	141.2	138.0	172.6	Fourth.....	80.4	78.9	67.7	50.0
Third.....	120.0	149.0	145.7	204.8	Average.....	100.0	100.0	100.0	100.0
Fourth.....	125.7	160.4	155.4	240.5					
July:									
First.....	122.3	152.4	152.4	235.5					
Second.....	110.0	144.7	149.7	227.8					

<sup>1</sup> Nov. 1, 1921, to Oct. 31, 1922, omitted because of milk-drivers' strike, which caused abnormal sales during the early part of that period.

In most of the wholesale outlets for dairy products the adult consumers predominate, whereas in the retail trade the greatest proportion of the milk consumption is by babies and young children. Because of the greater tendency of adults to change their consumption with the weather, wholesale sales of almost all dairy products rise in the summer and fall in the winter. Even the vacation migration, so pronounced in retail sales, is much less effective here because these employed adults ordinarily have but a very brief vacation. Furthermore, it appears logical to assume that dipped-milk sales are little affected by vacations because of the economic status of the purchasers. It also seems probable that there is some shift from retail deliveries to store purchases during the hottest months by families who are too poor to keep ice, and by that increasing class of people who depend on delicatessen stores for meal-to-meal purchases.

Wholesale sales of quarts of grade B milk reach a peak the 1st of August, at which time they are about 65 per cent above the low point. (Fig. 19.) Grade A milk sales reach their peak a month earlier and are only 30 per cent above the low point. Wholesale sales of grade B pints and grade B bulk milk also are highest at this time (fig. 20), the increases over winter sales being 65 and 35 per cent,



respectively. With the exception of quarts of grade B milk, the summer increase in wholesale sales is checked by the vacation movement out of the city. Since sales of quarts of grade B milk continue to rise until about the 1st of August, when the temperature reaches its maximum, it appears that this commodity is the one most af-

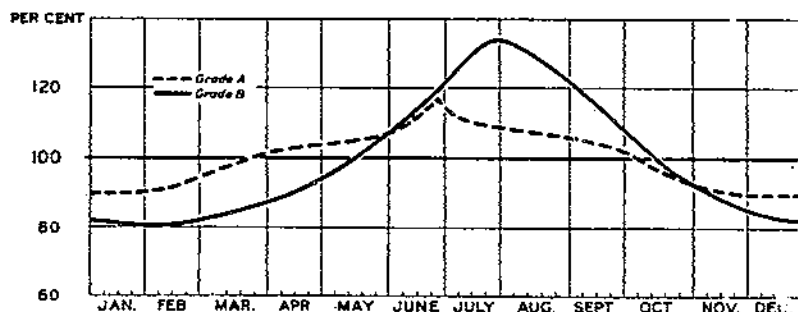


FIG. 19.—SEASONAL VARIATION IN THE WHOLESALE SALES OF QUARTS OF MILK, NEW YORK METROPOLITAN AREA, 1920-1924

Weekly sales expressed as percentages of the average for the year as shown by smoothed curves. Grade B sales reach a peak during the hottest weather, while grade A sales appear to be sufficiently affected by the vacation period to fall slightly at that time.

ected by the shift of the household trade from retail deliveries to store purchases.

Wholesale sales of extra-heavy cream are greatest at the height of the berry season, being about 75 per cent above the low point in December. (Fig. 21.) Sales of light cream and condensed milk,

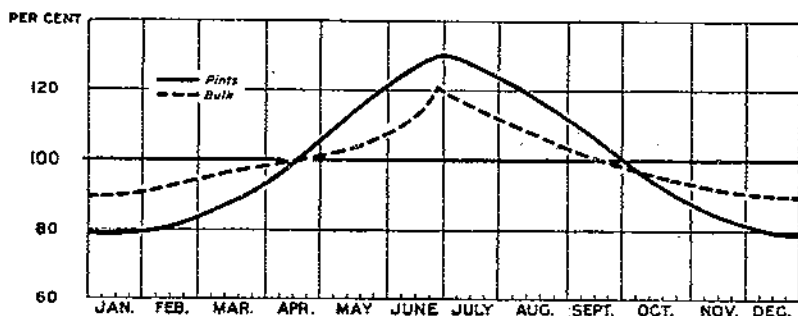


FIG. 20.—SEASONAL VARIATION IN THE WHOLESALE SALES OF GRADE B MILK, NEW YORK METROPOLITAN AREA, 1920-1924

Weekly sales expressed as percentages of the average for the year as shown by smoothed curves. Bulk milk and pints of bottled milk are both affected by the luncheon trade during the summer.

on the other hand, continue to rise until the last week in June, since the ice-cream demand affects them more than it does sales of the high-testing cream.

Wholesale sales of buttermilk show greater seasonal variation than do sales of any other commodity.<sup>6</sup> The maximum summer sales are five times as large as the minimum winter sales.

<sup>6</sup> The school trade in half pints of milk is, of course, an exception if the school period is compared with the vacation period.

When wholesale and retail sales are combined, the curve of seasonal variation naturally lies somewhere between the retail and the wholesale curve. The degree to which it resembles either of these, depends, of course, upon the proportionate quantities sold in the two ways. In

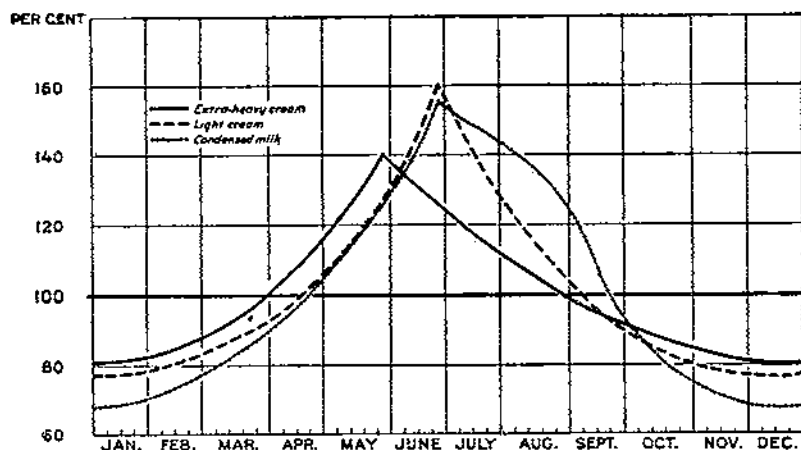


FIG. 21.—SEASONAL VARIATION IN WHOLESALE SALES OF CREAM AND CONDENSED MILK, NEW YORK METROPOLITAN AREA, 1920-1924

Weekly sales expressed as percentages of the average for the year as shown by smoothed curves. Extra heavy cream sales reach a peak when fresh berries are on the market. Light cream and condensed milk enter more largely into ice cream, so their peaks come a month later.

Table 16 and Figure 22 are shown the seasonal variation for all milk sales when weighted by the proportionate quantities sold by the 41 dealers included in Table 1. The monthly variation in milk receipts at the New York market is also shown in Figure 22, for comparison

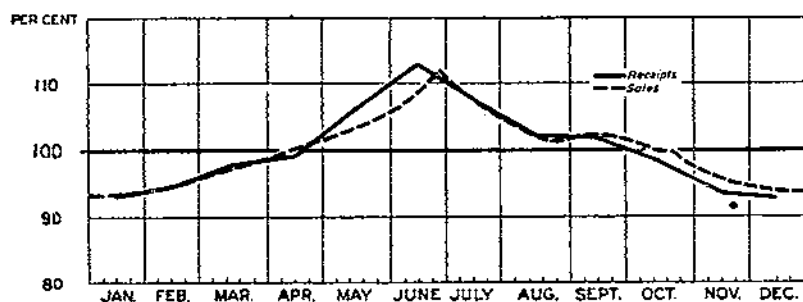


FIG. 22.—SEASONAL VARIATION IN RECEIPTS OF MILK AND IN SALES OF ALL MILK, NEW YORK METROPOLITAN AREA, 1920-1924

Monthly receipts and weekly sales expressed as percentages of the average for the year as shown by smoothed curves. The weekly sales curve shows the seasonal trend in demand more accurately than the monthly receipts.

with the weekly sales. The two curves correspond as closely as could be expected, considering the differences in the data. The bulk milk sold by small dealers not included here, and the milk used for ice cream, would easily account for the slightly higher receipts in summer.

TABLE 16.—*Seasonal variation in the sales of all milk and cream in New York metropolitan area,<sup>1</sup> 1920-1924*

[Percentage of average for the year]

Month and week	Milk	Cream	Month and week	Milk	Cream
<i>January:</i>	<i>Per cent</i>	<i>Per cent</i>	<i>July:</i>	<i>Per cent</i>	<i>Per cent</i>
First.....	93.4	83.6	First.....	110.0	125.2
Second.....	93.4	83.8	Second.....	108.3	120.5
Third.....	93.5	84.0	Third.....	106.7	116.2
Fourth.....	93.7	84.6	Fourth.....	105.4	112.3
<i>February:</i>			<i>August:</i>		
First.....	94.0	85.2	First.....	104.2	180.6
Second.....	94.5	86.3	Second.....	102.8	165.8
Third.....	95.0	87.4	Third.....	102.0	162.7
Fourth.....	95.6	88.5	Fourth.....	101.1	160.2
<i>March:</i>			Fifth.....	101.2	98.2
First.....	96.2	90.2	<i>September:</i>		
Second.....	96.9	92.0	First.....	101.7	96.7
Third.....	97.5	93.8	Second.....	102.0	95.5
Fourth.....	98.0	95.8	Third.....	102.0	94.3
Fifth.....	98.6	98.1	Fourth.....	101.7	93.0
<i>April:</i>			<i>October:</i>		
First.....	99.3	100.6	First.....	101.1	91.7
Second.....	99.0	103.4	Second.....	100.5	90.4
Third.....	100.4	106.4	Third.....	99.8	89.2
Fourth.....	101.0	109.6	Fourth.....	98.9	88.2
<i>May:</i>			Fifth.....	98.1	87.2
First.....	101.7	113.3	<i>November:</i>		
Second.....	102.4	117.5	First.....	97.1	86.3
Third.....	103.2	122.2	Second.....	96.2	85.4
Fourth.....	104.1	127.2	Third.....	95.5	84.6
Fifth.....	105.2	132.0	Fourth.....	94.9	83.6
<i>June:</i>			<i>December:</i>		
First.....	106.3	131.8	First.....	94.4	83.5
Second.....	107.7	131.4	Second.....	94.0	83.2
Third.....	109.5	131.2	Third.....	93.8	83.1
Fourth.....	112.6	131.0	Fourth.....	93.6	83.3
			Average.....	100.0	100.0

<sup>1</sup> Weighted by the proportionate amounts sold by 41 dealers during February, 1927.

## DAY-OF-THE-WEEK VARIATION IN DEMAND

The third important regular variation in sales, is day-of-the-week variation. The consumption habits of the people in the New York market are such as to cause definite daily variations in the demand for milk and cream. (Tables 17 to 19.) When the whole metropolitan area is considered, the magnitude of these variations depends largely upon the proportion of the specific product that is consumed by adults. When different districts in the city are considered, the daily variation in the demand for any given product appears to depend upon the economic status of the consumers and upon the number of working people who lunch away from home on week days.

TABLE 17.—*Day-of-the-week variation in the retail sales of various dairy products in the New York metropolitan area, 1924<sup>1</sup>*

Product	Percentage of average for the week						
	Sun-day	Mon-day	Tues-day	Wednes-day	Thurs-day	Friday	Satur-day
Quarts of certified milk.....	98.9	100.9	99.8	100.6	100.6	100.3	98.0
Quarts of grade A milk.....	100.5	100.0	100.2	100.3	99.8	99.8	99.4
Quarts of grade B milk.....	103.7	99.5	99.6	99.8	99.2	99.3	98.9
Pints of grade B milk.....	77.6	104.8	106.9	108.0	108.0	107.2	85.5
Half pints of extra-heavy cream.....	179.3	83.4	88.8	92.3	86.2	82.1	90.9
Half pints of light cream.....	108.0	98.0	99.7	103.5	97.8	96.6	96.4
Half pints of condensed milk.....	106.0	96.9	99.0	105.8	93.8	94.7	103.8
Quarts of buttermilk.....	76.4	106.9	106.6	106.3	102.9	106.5	94.5

<sup>1</sup> See Tables 36 to 58 in the appendix for day-of-the-week variation by sections of the city and by months.

TABLE 18.—*Day-of-the-week variation in the wholesale sales of various dairy products in the New York metropolitan area, 1924*<sup>1</sup>

Product	Percentage of average for the week						
	Sun-day	Mon-day	Tues-day	Wed-nesday	Thurs-day	Friday	Satur-day
Quarts of grade B milk.....	92.8	99.4	100.8	99.6	100.8	102.2	104.4
Pints of grade B milk.....	46.8	115.2	116.8	115.7	118.4	115.0	71.2
Grade B bulk milk.....	73.5	107.3	103.1	104.2	104.3	107.2	100.4
Extra-heavy cream.....	72.9	107.7	88.9	91.4	86.6	112.2	140.3
Light cream.....	42.3	118.9	95.6	93.7	94.9	121.8	132.8
Condensed milk.....	42.7	114.5	86.9	93.4	83.6	130.6	148.3
Buttermilk.....	34.4	126.5	106.0	109.2	114.4	115.0	94.6

<sup>1</sup> See Tables 30 to 58 in the appendix for day-of-the-week variation by sections of the city and by months.TABLE 19.—*Day-of-the-week variation in the sales of all milk and of cream in the New York metropolitan area*<sup>1</sup>

Day	Percentage of average for the week		Day	Percentage of average for the week	
	Milk	Cream		Milk	Cream
Sunday.....	90.2	84.7	Friday.....	102.8	108.7
Monday.....	102.7	105.9	Saturday.....	99.6	127.9
Tuesday.....	101.4	91.1	Average.....	100.0	100.0
Wednesday.....	101.7	92.6			
Thursday.....	101.6	89.1			

<sup>1</sup> Weighted by the proportionate amounts sold by 41 dealers during February, 1927.

Certified milk shows little fluctuation in any part of the city, because it is purchased largely for babies. Quarts of grade A milk rank next to certified milk as food for young children, and the day-of-the-week variation for this product is greater than for certified milk but not so great as for quarts of grade B milk. (Fig. 23.) On Sunday the sales of quarts of both grade A and grade B milk are higher than on other days in most of the residential districts. In some of the business districts, however, Sunday sales are below the average for the week because of the loss of a certain amount of luncheon trade. For the entire metropolitan area, the Sunday sales of quarts of grade B milk are about 4 per cent above the average for the week. This is due, in part, to the fact that employed members of families have their noon meal at home on that day.

A very appreciable part of the milk sold in pint bottles is consumed by these workers as a luncheon beverage. Consequently, the Sunday holiday and the Saturday half holiday cause a decided drop in demand. (Fig. 24.) The greatest decrease on these two days is found in the business districts of the city, since it is here that the number of employed people who lunch away from home is the greatest. Thus, in the lower part of Manhattan, the Sunday sales are only about 44 per cent of the Monday-to-Friday daily average, whereas in one of the residential districts in the Bronx they are 92 per cent of the average for those five days. The Saturday and Sunday sales for the entire metropolitan area, as represented by the sampling of 21 of the 42 districts, are, respectively, 85.5 and 77.6 per cent of the week's average.

To check the accuracy of this sampling, the day-of-the-week variation in sales of quarts of grade B milk was computed for the same 21 districts and compared with the variation for the entire metropolitan area. The average difference was less than 0.3 per cent, and the maximum difference was only 0.6 per cent. From this comparison it appears that the sampling gives an accurate picture of the entire market. Such slight error as exists appears to be due to a too heavy weighting of the Manhattan districts.

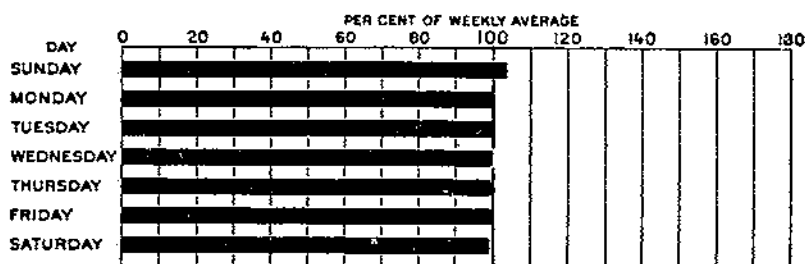


FIG. 23.—DAILY RETAIL SALES OF QUARTS OF GRADE B MILK, NEW YORK METROPOLITAN AREA, 1924

Daily sales expressed as percentages of the average for the week. Sales of this product are largely for household consumption and are little affected by days of the week

Retail sales of heavy cream show the greatest day-of-the-week variation. Approximately twice as much cream is required on Sunday as on other days. (Fig. 25.) The Sunday demand is greatest in residential districts where cream is looked upon as something of a luxury and is therefore purchased only on special occasions. In some localities the Sunday sales are three and one-half times the week-day sales.

Retail sales of light cream and of condensed milk show much less variation on Sunday. This is to be expected, since these products

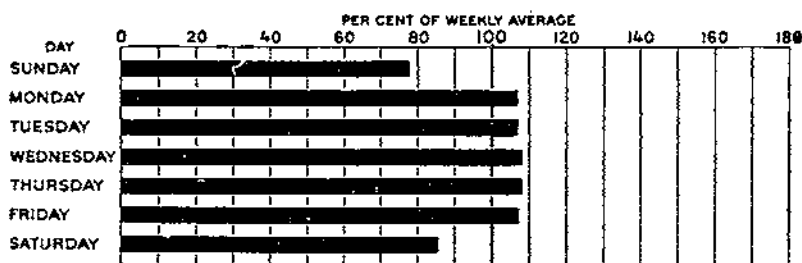


FIG. 24.—DAILY RETAIL SALES OF PINTS OF GRADE B MILK, NEW YORK METROPOLITAN AREA, 1924

Daily sales expressed as percentages of the average for the week. Saturday and Sunday sales are low because most employed persons eat their noon meals at home on these days, and the luncheon trade in pints is thereby decreased

are commonly used daily in coffee, whereas heavy cream is more likely to be purchased for a special Sunday dessert.

Much of the retail demand for buttermilk in the business sections of the city is the result of the luncheon trade, and sales fall very low on Sunday. In the residential parts of the area, the week-end decrease is much less.

These tables of daily variation are based on averages for an entire year. When day-of-the-week variations are computed for each

month, the prevalence of week-end trips out of the city during the summer is clearly shown. In April, Sunday sales of quarts of grade B milk are 4.8 per cent above the weekly average, whereas in July they are only 1.7 per cent above the average. Grade A milk and certified milk sales on Sunday are actually below the average for the week during the hottest months. Pints of grade B milk, which are already low on Sunday, fall about 5 per cent lower in the summer. On the other hand, day-of-the-week variations in the retail sales of extra-heavy cream appear to be more affected by the berry season than by week-end trips. In other words, the number of families allowing themselves the luxury of heavy cream on Sundays causes sales on that day to rise from about 164 per cent of the week's average in January to 194 per cent in May, with a gradual decline to 168 per cent in December. Retail sales of light cream, condensed milk, and butter-milk also show the effect of large numbers of people leaving the city over the week-end during the summer.

Daily sales of butter, eggs, and cottage cheese on retail milk routes in New York do not represent a normal day-of-the-week demand. These products sell best if they are called to the attention of the

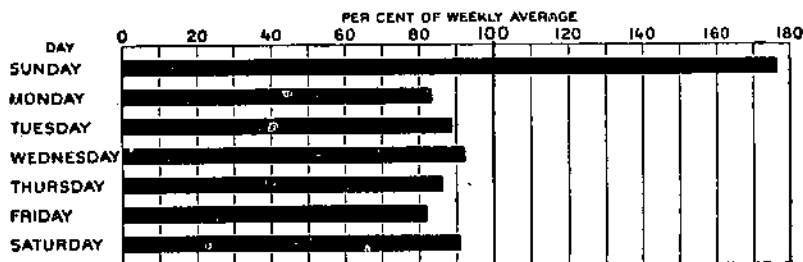


FIG. 25.—DAILY RETAIL SALES OF HALF-PINTS OF EXTRA-HEAVY CREAM, NEW YORK METROPOLITAN AREA, 1924

Daily sales expressed as percentages of the average for the week. Sunday sales of cream are very much higher than those on other days, especially in districts where cream is considered a luxury

housewife. Since the milk driver does not see her on his early morning delivery, he is frequently instructed to push the sale of these products when he makes his weekly collection on Monday or Tuesday. Therefore, these two days show sales far in excess of a normal consumptive demand. In some of the more congested districts, the sales on other days are practically negligible, but in some of the suburban districts, where stores are more scattered, the convenience of the daily delivery results in a fair demand throughout the week.

Wholesale sales of milk and cream are naturally much affected by the closing of offices and places of business on Sunday. (Table 18 and figs. 26 and 27.) Quarts of grade B milk show only a slight decrease on Sunday because, for the most part, they are consumed in the home. Pints of grade B milk, on the other hand, enter so largely into the luncheon trade that the Sunday sales fall to 47 per cent of the weekly average. Grade B bulk milk, representing both the dipped-milk or home-consumption trade and the restaurant or luncheon trade, shows a decrease midway between these two.

Bulk sales of extra-heavy cream rise to 140 per cent of the week's average on Saturday in anticipation of the next day's demand. The

sales actually occurring on Sunday, however, are only half those of Saturday. Similarly, wholesale sales of light cream and condensed milk are high on Saturday but fall to 42 per cent of the average on Sunday. In all probability, some of the cream and condensed milk sold on Saturday is served the next day in the form of ice cream.

The Sunday demand for buttermilk through wholesale channels is only about one-third of the average for the week.

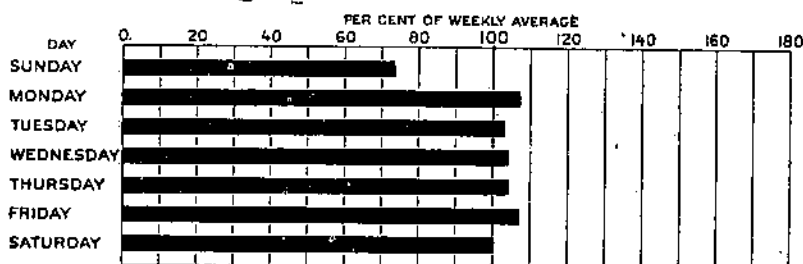


FIG. 26.—DAY-OF-THE-WEEK VARIATION IN THE WHOLESALE SALES OF GRADE B BULK MILK, NEW YORK, METROPOLITAN AREA, 1924

Daily sales expressed as percentages of the average for the week. The demand for bulk milk also falls off over the week-end.

#### HOLIDAY VARIATION IN DEMAND

The magnitude of the holiday variation in retail sales of milk, as well as that of the day-of-the-week variation, depends upon the proportion of the commodity that is consumed by persons who lunch away from home. For instance, the quart trade, which is largely for home consumption, is little affected by any of the holidays. Pint sales, on the other hand, fall off almost 30 per cent on holidays which are marked by the closing of business places on week days.

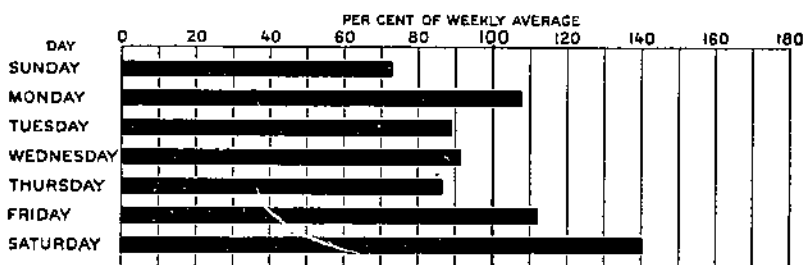


FIG. 27.—DAY-OF-THE-WEEK VARIATIONS IN THE WHOLESALE SALES OF EXTRA-HEAVY CREAM, NEW YORK, METROPOLITAN AREA, 1924

Daily sales expressed as percentages of the average for the week. Wholesale sales of cream, unlike retail sales, are lowest on Sunday.

Similarly, sales of bulk milk are largely for adult consumption, and the holiday variation for this product is about the same as for pints of grade B milk. Retail sales of cream show increases on most holidays, whereas wholesale sales usually decline. On the day preceding the holiday, however, wholesale sales of extra-heavy cream frequently rise sufficiently to more than offset the loss on the holiday. Sales of grade B bulk milk appear to be so affected only to a very slight degree.

Holidays that fall on week days, and particularly those that permit an out-of-town trip, usually result in decreases in the sale of

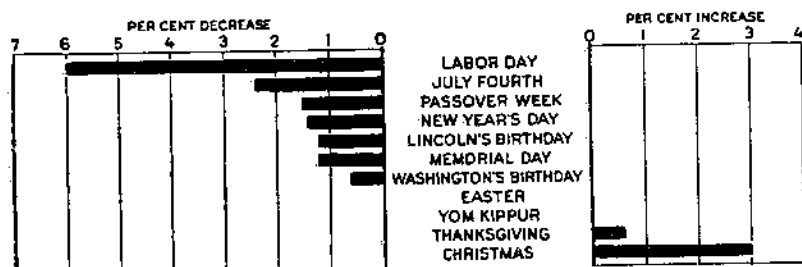


FIG. 28.—EFFECT OF HOLIDAYS ON THE RETAIL SALES OF QUARTS OF GRADE B MILK, NEW YORK METROPOLITAN AREA, 1924

Percentage change from the average corrected sales for the three days preceding and the three days following the holiday. Sales of this product are little affected except on Labor Day, Christmas, and the Fourth of July. Note the difference in scale when comparing with Figures 20, 30, and 31

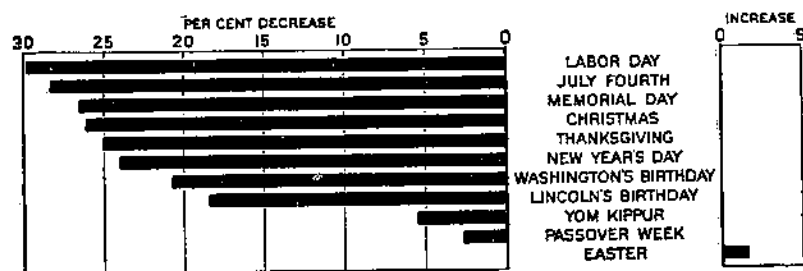


FIG. 29.—EFFECT OF HOLIDAYS ON RETAIL SALES OF PINTS GRADE B MILK, NEW YORK METROPOLITAN AREA, 1924

Percentage change from the average corrected sales for the three days preceding and the three days following the holiday. Since many employed persons purchase a pint of milk to drink with their lunch, any general holiday causes a decline in sales. Note the difference in scale when comparing with Figures 28, 30, and 31

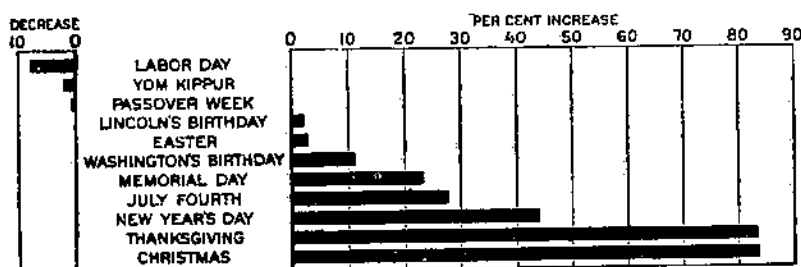


FIG. 30.—EFFECT OF HOLIDAYS ON RETAIL SALES OF HALF-PINTS OF EXTRA-HEAVY CREAM, NEW YORK METROPOLITAN AREA, 1924

Percentage change from the average corrected sales for the three days preceding and the three days following the holiday. Thanksgiving and Christmas feasts demand large quantities of cream, especially in middle-class residential districts. Note the difference in scale when comparing with Figures 28, 29, and 31

most dairy products. Thus, July Fourth and Labor Day show decreased sales for all commodities except cream. (Tables 20 and 21 and figs. 28-31.)



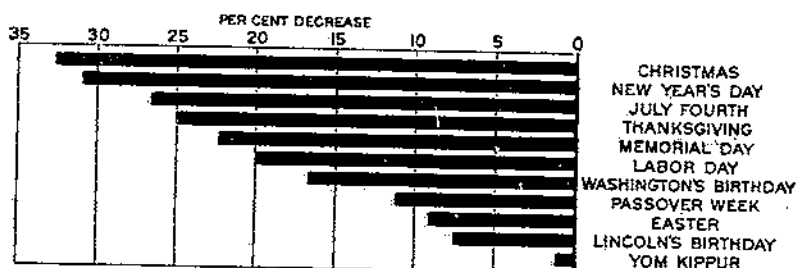


FIG. 31.—EFFECT OF HOLIDAYS ON THE WHOLESALE SALES OF GRADE B BULK MILK, NEW YORK METROPOLITAN AREA, 1924

Percentage change from the average corrected sales for the three days preceding and the three days following the holiday. The effect of closed stores and decreased patronage of restaurants and lunch rooms is shown in the sales of this product. Note the difference in scale when comparing with Figures 28, 29, and 30.

TABLE 20.—Effect of holidays on the sales of milk in the New York metropolitan area, 1924

Holiday	Changes in sales <sup>1</sup>					
	Retail <sup>2</sup>				Wholesale, grade B bulk milk	Combined, all milk <sup>3</sup>
	Quarts of grade B milk	Quarts of grade A milk	Quarts of certified milk	Pints of grade B milk		
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
New Year's Day	-1.4	0	-3.0	-24.0	-30.9	-15.1
Lincoln's Birthday	-1.2	-1.2	-1.8	-18.4	-7.5	-4.4
Washington's Birthday	-0.6	-0.6	-2.9	-20.7	-16.7	-8.4
Easter	0	-0.8	0	-1.6	-9.1	-4.2
Passover week	-1.5	-1.4	-1.8	-2.6	-11.2	-5.9
Memorial Day	-1.2	-1.2	-1.2	-20.5	-22.3	-11.4
Fourth of July	-2.4	-2.4	-1.8	-28.3	-26.6	-14.0
Labor Day	-0.0	-4.8	-6.6	-29.8	-19.9	-12.6
Yom Kippur	0	0	-0.8	-5.6	-1.1	-0.6
Thanksgiving	+0.0	+0.6	-1.2	-25.1	-25.0	-11.8
Christmas	+3.0	+1.2	-1.8	-26.1	-32.6	-14.2

<sup>1</sup> Percentage change from the average corrected sales for the 3 days preceding and the 3 days following the holiday.

<sup>2</sup> See Tables 59 to 62 in the appendix for effect of holidays in different sections of the city.

<sup>3</sup> Weighted by the proportionate amounts sold by 41 dealers during February, 1927.

<sup>4</sup> Average change for the week in percentages of the average corrected sales for the preceding and the following week.

TABLE 21.—Effect of holidays on sales of extra-heavy cream in the New York metropolitan area, 1924

Holiday	Change in sales <sup>1</sup>			
	Retail <sup>2</sup>	Wholesale		
		On holiday	On previous day	Net change
	Per cent	Per cent	Per cent	Per cent
New Year's Day	+44.1	-0.2	+20.0	+10.8
Lincoln's Birthday	+2.1	+12.5	-8.2	+4.3
Washington's Birthday	+11.1	-10.4	0	-10.4
Easter	+2.8	-15.3	-30.9	-43.2
Passover week	-6	-13.7	0	-13.7
Memorial Day	+23.3	-13.8	+74.6	+80.8
Fourth of July	+27.8	-10.5	+6.8	+9.7
Labor Day	-7.8	+27.3	-9.2	+10.3
Yom Kippur	-1.9	+8.3	+52.0	+58.4
Thanksgiving	+83.4	-7.0	+21.2	+13.3
Christmas	+83.7	-17.0	+20.3	+2.7

<sup>1</sup> The effect of the holidays on sales of heavy cream is measured by finding the percentage changes from the average corrected sales for the 3 days preceding and the 3 days following the holidays.

<sup>2</sup> See Table 63 in the appendix for effect of holidays in different sections of the city.

<sup>3</sup> Average change for the week in percentages of the average corrected sales for the preceding and the following week.

Religious holidays affect sales in a somewhat variable manner. Since Easter is always on Sunday, offices and factories are already closed, and there is but little change from the usual Sunday demand. It appears logical to assume that the decrease in sales due to the closing of business places on other holidays would be largely lost in the years when these holidays fall on Sunday. Passover week, occurring in April, results in a decrease of about 11 per cent in the sales of bulk milk. Since this period covers a week, the loss in sales is more serious than is a similar decrease for a single holiday.

Holidays like Thanksgiving, Christmas, and New Year's Day, which are usually occasions for feasting, result in a decreased luncheon trade in pints and in bulk milk, but in a greatly increased demand for cream. Retail sales of heavy cream in the whole area go up 83.4, 83.7, and 44 per cent, respectively, on those three days.

Sales of milk and cream in different districts of the metropolitan area are affected by holidays to varying degrees. Quarts of grade B, grade A, and certified milk show declines in the business districts on most holidays, whereas many of the residential districts show increases on Thanksgiving, Christmas, and New Year's Day. Sales in practically all districts, with the exception of those including beach resorts, decline on Labor Day. In the sale of pints of milk, business districts show the greatest decline, and the better residential districts show the least.

The greatest variability between districts is found in the retail sales of extra-heavy cream. Although the entire area requires about 84 per cent more cream than usual to meet the Christmas demand, certain districts increase their purchases 300 per cent, or, in other words, demand four times the normal quantity of cream.

It should be noted that the foregoing figures are based only on one year's sales, and are therefore more subject to error than are the seasonal or the day-of-the-week variations. This is particularly true of the data by districts. The effect of holidays in other years was computed for a few of the most important commodity sales in the whole area, and was found to check rather closely with that shown here. It is felt, therefore, that these figures may be taken as illustrating what is to be expected under normal conditions.

#### EFFECT OF TEMPERATURE FLUCTUATIONS ON DEMAND

In addition to the seasonal changes in temperature which have already been discussed, there are numerous short-time fluctuations. These sudden changes are much greater in winter than in summer, but a careful month-by-month study of their effect on milk sales indicates that when consumers have adjusted their consumption to winter conditions a sudden rise or fall in temperature does not greatly affect sales. A similar fluctuation in the summer, however, may have a marked effect on demand. Roughly speaking, a 10 per cent change in temperature will have three times as much effect on sales in summer as in winter. For this reason only the six months from April to September, inclusive, were used in studying the effect of temperature.

To make the application of these data as practical as possible, comparisons of both sales and temperature were made with previous periods rather than with the usual theoretical normal which requires the projection of the lines of trend. That is, deviations of weekly

sales and temperatures are expressed as percentages of the preceding three-weeks' average, and daily deviations are expressed as percentages of the preceding seven-days' average.

The degree of relationship between the weekly average maximum temperature and the sales of various grades of milk is shown by Table 22. If a given change in temperature always resulted in a corresponding change in sales, the two factors would be said to correlate perfectly, and the coefficient expressing that relationship would be +1. If there was no relationship between sales and temperature, the correlation coefficient would be 0. Hence, the more nearly the coefficients in these tables approach 1, the closer is the relationship.

For the six summer months, April to September, sales of certified milk and temperature show no significant correlation. This might be expected, because this grade of milk is consumed almost entirely by babies, and its sales are therefore unaffected by the tendency of adults to shift from hot to cold drinks and back again as the mercury rises and falls. The same is true to a lesser extent in the case of grade A milk, since a large part of it is consumed by children. Pints of grade B milk come next in the retail sales, followed by quarts of grade B milk and buttermilk. The last-named product is consumed very largely by adults and sales are much affected by the weather. With the exception of pints of grade B milk, all the wholesale sales show a higher degree of correlation than do the retail sales, because of the larger proportion consumed by adults.

TABLE 22.—Correlation between the weekly average maximum temperature and the weekly average sales of milk during the six summer months April to September, 1919-1924<sup>1</sup>

Commodity	Correlation between temperature and—			
	Retail sales		Wholesale sales	
	Correlation coefficient	Probable error	Correlation coefficient	Probable error
Quarts of grade B milk.....	+0.848	±0.052	+0.553	±0.053
Quarts of grade A milk.....	+0.218	±0.056		
Quarts of certified milk.....	+0.078	±0.065		
Pints of grade B milk.....	+0.273	±0.055	+0.210	±0.063
Grade B bulk milk.....			+0.470	±0.052
Buttermilk.....	+0.497	±0.049	+0.549	±0.046

<sup>1</sup> Maximum temperature corrected for seasonal variation. Sales of milk corrected for secular trend, seasonal variation, and holiday variation. Both expressed as percentage deviations from the average for the preceding 3 weeks. Perfect agreement between temperature and sales would be expressed by the correlation coefficient +1. See Table 64 in the appendix for correlations by months.

The correlation coefficients shown in Table 22 indicate the degree of certainty with which sales will follow temperature, but they do not necessarily indicate the magnitude of the change in demand occasioned by a given change in temperature. In Tables 23 and 24 and in Figure 32 it is seen that the effect varies considerably with different products. For instance, if the average maximum temperature for a given week is 20 per cent below the average for the previous three weeks, retail sales of quarts of grade B milk will fall less than 1 per cent below the average, whereas retail sales of buttermilk will fall 10

per cent. Wholesale sales of these products will fall 11 and 35 per cent, respectively. With a 20 per cent increase in temperature, the increases in sales range from about 2 per cent for quarts of grade A milk at retail, to 45 per cent for buttermilk at wholesale. In practically all cases, the products which show the greatest seasonal rise in sales during the summer are the ones which are most affected by the short-time temperature fluctuations.

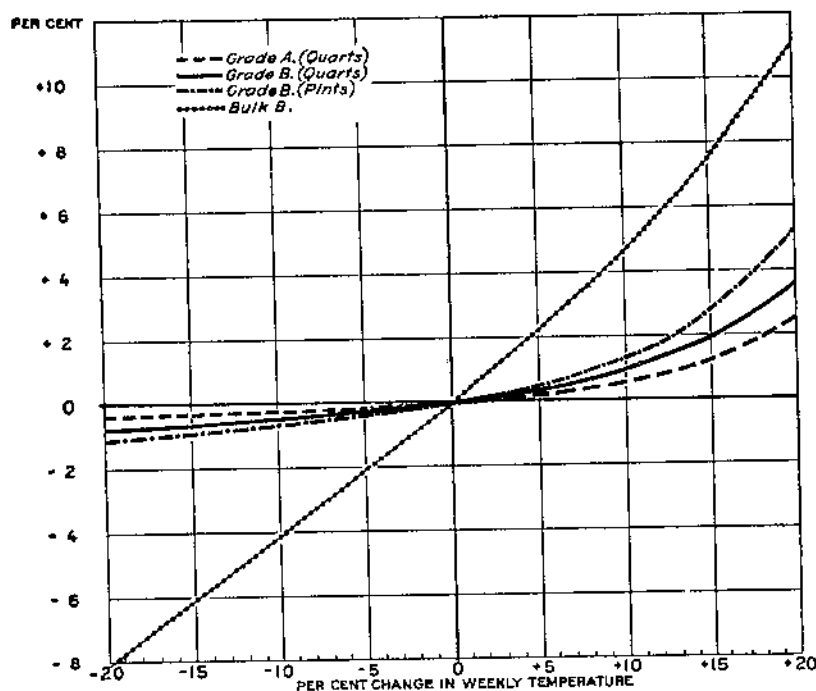


FIG. 32. EFFECT OF TEMPERATURE CHANGES ON RETAIL SALES OF BOTTLED MILK, NEW YORK METROPOLITAN AREA, 1919-1924, AND ON WHOLESALE SALES OF BULK MILK, 1920-1924

Variations in average weekly temperatures and sales expressed as percentages of the average of the preceding three weeks. When the temperature rises sales increase, and when the temperature falls sales decrease

TABLE 23.—Effect of weekly temperature changes on retail sales of milk in the New York metropolitan area during the six summer months, April to September, 1919-1924

Change in temperature <sup>1</sup>	Change in sales <sup>1</sup>				Change in temperature <sup>1</sup>	Change in sales <sup>1</sup>			
	Quarts of grade B milk	Quarts of grade A milk	Pints of grade B milk	Quarts of buttermilk		Quarts of grade B milk	Quarts of grade A milk	Pints of grade B milk	Quarts of buttermilk
Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
+20	+9.8	+0.4	+1.1	+10.4	+5	+0.4	+0.2	+0.5	+2.8
+15	+7	—	—	+7.9	+10	+1.0	+0.6	+1.4	+5.8
+10	+5	—	—	+5.3	+15	+1.9	+1.2	+2.8	+9.2
+5	+3	—	—	+2.7	+20	+3.7	+2.5	+5.3	+13.2

<sup>1</sup> Expressed as percentage deviations from the average of the preceding 3 weeks.

TABLE 24.—Effect of weekly temperature changes on wholesale sales of milk in the New York metropolitan area during the six summer months, April to September, 1920-1924

Change in temperature	Change in sales <sup>1</sup>				Change in temperature	Change in sales <sup>1</sup>			
	Quarts of grade B milk	Pints of grade B milk	Grade B bulk milk	Butter-milk		Quarts of grade B milk	Pints of grade B milk	Grade B bulk milk	Butter-milk
Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
-20	-11.0	-8.0	-8.1	-35.5	+5	+3.0	+1.0	+2.3	+0.8
-15	-8.1	-4.6	-0.1	-27.0	+10	+6.3	+3.4	+4.7	+20.0
-10	-5.6	-3.1	-4.1	-18.2	+15	+9.9	+5.3	+7.5	+31.5
-5	-2.8	-1.6	-2.1	-0.1	+20	+15.2	+7.5	+10.9	+45.2

<sup>1</sup> Expressed as percentage deviations from the average of the preceding 3 weeks.

For a number of products, the temperature on a given day and the sales of milk on the following day are more highly correlated than are weekly temperature and sales. (Table 25.) The degrees of correlation shown by the various grades, however, bear about the same relation in both cases. That is, products consumed by adults follow both weekly and daily temperature fluctuations with greater certainty than do those consumed by children. The one-day lag of sales behind temperature results from the practice of early morning deliveries of milk. A hot day causes the housewife or the restaurant manager to order extra milk for the next day, since the delivery has already been made that morning.<sup>7</sup>

TABLE 25.—Correlation between the maximum temperature on a given day and the sales of milk on the following day during the six summer months, April to September, 1924<sup>1</sup>

Commodity	Correlation between temperature and—			
	Retail sales		Wholesale sales	
	Correlation coefficient	Probable error	Correlation coefficient	Probable error
Quarts of grade B milk	+0.357	±0.044	+0.426	±0.041
Quarts of grade A milk	+0.201	±0.048		
Quarts of certified milk	+0.030	±0.051		
Pints of grade B milk	+0.356	±0.044		
Grade B bulk milk			+0.263	±0.047
Buttermilk			+0.606	±0.032
	+0.533	±0.036	+0.570	±0.034

<sup>1</sup> Maximum temperature corrected for seasonal variation. Sales of milk corrected for secular trend and for seasonal, day-of-the-week, and holiday variations. Both expressed as percentage deviations from the average for the preceding 7 days. Perfect agreement between temperature and sales would be expressed by the correlation coefficient +1. See Table 65 in the appendix for correlations by months.

The extent to which daily sales are affected by daily fluctuations in temperature is shown in Tables 26 and 27 and in Figure 33.<sup>8</sup> Here again those products which reach adult consumers, either in the home or in public eating places, show the greatest variation due to

<sup>7</sup> The correlation coefficient for daily temperatures and sales of quarts of grade B milk on the same day is +0.177 ±0.048 as compared with +0.357 ±0.044 for sales the next day. Similarly the correlation of pints of grade B milk and temperature is +0.201 ±0.048 with no lag, and +0.356 ±0.044 with a lag of one day.

<sup>8</sup> It will be noted from Figures 32 and 33 that daily sales are affected more by a decrease in temperature than by an increase, whereas the opposite is true for weekly sales. The demand for milk in Chicago shows the same relation of daily and weekly sales.

this cause. With a 20 per cent decrease in temperature, the decreases range from less than 1 per cent for retail sales of quarts of grade A milk to 36 per cent for wholesale sales of buttermilk. With a 20 per cent increase in temperature, the increases range from 0.4 per cent for quarts of grade A milk at retail to 22.5 per cent for buttermilk at wholesale.

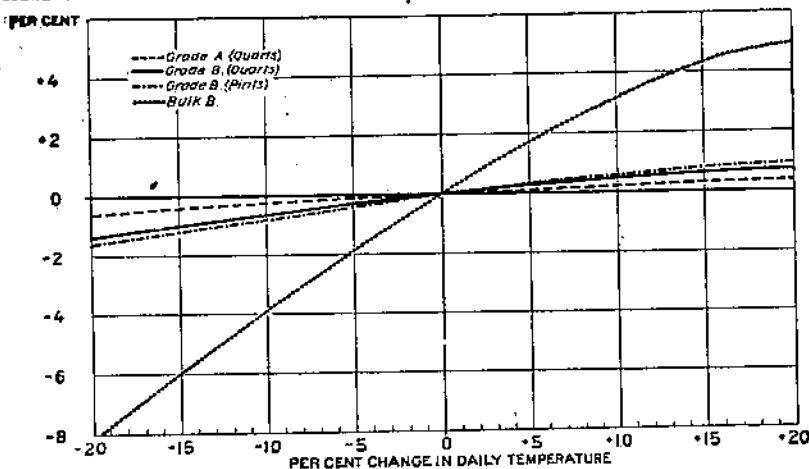


FIG. 33. EFFECT OF TEMPERATURE CHANGES ON RETAIL SALES OF BOTTLED MILK AND ON WHOLESALE SALES OF BULK MILK, NEW YORK METROPOLITAN AREA, 1924

Variations in daily temperatures and sales expressed as percentages of the average of the preceding 7 days. Since bulk milk is consumed largely by adults, it is most affected by temperature changes

TABLE 26.—Effect of daily temperature changes on retail sales of milk in the New York metropolitan area during the six summer months, April to September, 1924

Change in temperature †	Change in sales the following day †				Change in temperature †	Change in sales the following day †			
	Quarts of grade B milk	Quarts of grade A milk	Pints of grade B milk	Quarts of buttermilk		Quarts of grade B milk	Quarts of grade A milk	Pints of grade B milk	Quarts of buttermilk
Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
+20	+1.3	+0.6	+1.6	+14.0	+5	+0.3	+0.1	+0.3	+3.0
+15	+1.0	—	+1.2	+10.4	+10	+0.5	+0.2	+0.6	+5.6
+10	—	—	—	+6.8	+15	+0.6	+0.3	+0.8	+7.6
+5	—	—	—	+3.3	+20	+0.7	+0.4	+0.9	+8.8

† Expressed as percentage deviations from the average for the preceding 7 days.

TABLE 27.—Effect of daily temperature changes on wholesale sales of milk in the New York metropolitan area during the six summer months, April to September, 1924

Change in temperature †	Change in sales the following day †				Change in temperature †	Change in sales the following day †			
	Quarts of grade B milk	Pints of grade B milk	Grade B bulk milk	Buttermilk		Quarts of grade B milk	Pints of grade B milk	Grade B bulk milk	Buttermilk
Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
+20	+7.2	+7.3	+8.0	+35.5	+5	+1.5	+1.5	+1.7	+7.5
+15	+5.3	+5.4	+5.0	+26.8	+10	+2.8	+2.8	+3.2	+14.5
+10	+3.5	+3.5	+3.8	+17.7	+15	+3.8	+3.7	+4.3	+19.6
+5	+1.7	+1.7	+1.8	+8.5	+20	+4.4	+4.2	+5.0	+22.5

† Expressed as percentage deviations from the average for the preceding 7 days.

Since sales of milk are affected by temperature, other climatological factors were studied to see whether they also caused variations in demand. (Table 28.) The moisture in the air, expressed as relative humidity, was correlated with sales of milk. From the gross correlation coefficients thus obtained, it might have been concluded that the sales decrease as the amount of moisture increased. Further study, however, showed that the amount of moisture in the air and the maximum temperature for a given day were inversely proportional. By using net or partial correlation methods, it was found that there was no significant relation between humidity and sales if the temperature was constant. In other words, the decrease in sales which appeared to be due to an increase in the relative humidity was actually due to a drop in temperature.<sup>9</sup>

TABLE 28.—*Effect of temperature changes on sales of all milk in the New York metropolitan area<sup>1</sup>*

Change in tem- per- ature <sup>2</sup>	Change in sales <sup>2</sup>		Change in tem- per- ature <sup>2</sup>	Change in sales <sup>2</sup>	
	Weekly	Daily		Weekly	Daily
<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
-20	-4.3	-4.1	+5	+1.3	+0.8
-15	-3.3	-3.1	+10	+2.7	+1.6
-10	-2.2	-2.0	+15	+4.5	+2.2
-5	-1.1	-0.9	+20	+7.2	+2.5

<sup>1</sup> Weighted by the proportionate quantities sold by 41 dealers during February, 1927.

<sup>2</sup> Weekly sales and temperature deviations expressed as percentages of the average for the preceding 3 weeks. Daily sales and temperature deviations expressed as percentages of the average for the preceding 7 days.

Sales of milk and amount of rainfall were correlated in a similar manner, but no significant relation was shown except in the case of pints of grade B milk sold on the same day as the rainfall. Apparently a shower causes the pint sales to decrease slightly, probably because that part of the trade is with construction workers and like laborers who might be more influenced by weather conditions than would office or store employees. The relationship, however, is too uncertain to be of much practical importance.

#### EFFECT OF PRICE CHANGES ON DEMAND

From November 1, 1907, to October 20, 1916, the retail price of a quart of grade B milk in New York City remained stationary at 9 cents. During that period the cost of producing milk had been steadily increasing, without a corresponding advance in the prices paid to producers. This acute situation precipitated a milk strike in October, 1916, and the retail price was advanced 1 cent per quart to cover the increase obtained by the producers.

During these nine years of unchanged prices, consumers had learned to look on the retail milk price of 9 cents as a fixture, although they were accustomed to fluctuations in the prices of almost all other foods. Consequently the advance to 10 cents met with much opposition, and, according to reports of milk dealers, consumption was materially curtailed. The reaction of the consumers had a psycho-

<sup>9</sup> For example, the gross correlation of relative humidity and sales of pints of grade B milk was  $-0.185 \pm 0.048$ , but the net correlation was only  $-0.030 \pm 0.050$ . The gross and net correlations of temperature and sales, however, were  $+0.356 \pm 0.044$  and  $+0.351 \pm 0.044$ , respectively.

logical rather than an economic basis, because milk was a relatively cheap food even after the price was advanced. Since that time there have been many changes in the retail price of milk, and consumers have become accustomed to a varying price. The effect of these changes on the demand for various grades of milk is shown in Table 29.

TABLE 29.—Effect of price change on sales of milk in the New York Metropolitan area, 1919-1924

Price change	Number of changes	Commodity	Average change in sales following change in price <sup>1</sup>					
			First week	Second week	Third week	Fourth week	Fifth week	Average for 5 weeks
			<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
Decrease of 1 cent per unit.	11	Grade B quarts.....	+0.5	+1.0	+0.4	+0.2	+1.1	+0.6
	12	Grade A quarts.....	+1.1	+1.8	+1.1	+1.0	0	+1.7
	6	Grade B pints.....	+1.5	+0	+0	+2.6	+2.8	+1.7
	12	Grade B bulk <sup>2</sup> .....	+5	+1.2	-2	-4	+9	+4
	10	Grade B quarts.....	-2	-2	-7	-4	-5	-4
Increase of 1 cent per unit.	7	Grade A quarts.....	-5	-4	-2	+1	+3	-1
	4	Grade B pints.....	-1.9	-3.3	-2.2	-1.8	-2.2	-2.3
	12	Grade B bulk <sup>2</sup> .....	-1.9	-1.2	-1.3	-1.6	-1.0	-1.4
	1	Grade B quarts.....	-4.8	-6.5	-6.2	-7.7	-7.2	-6.5
	1	Grade A quarts.....	-7.9	-11.6	-11.9	-12.7	-12.1	-11.2
Increase of more than 1 cent per unit. <sup>3</sup>	1	Grade B pints.....	-7.5	-13.9	-18.0	-13.9	-17.3	-14.3
	1	Grade B bulk.....	-14.3	-12.0	-12.2	-11.7	-1.8	-10.4

<sup>1</sup> Changes in sales expressed as percentage deviations from the average of the corrected sales for the 5 previous weeks.

<sup>2</sup> Weighted average of several fractional price changes, ranging from one-half cent to 2 cents a quart.

<sup>3</sup> Grade B quarts and grade A quarts, 2 cents; grade B pints, 1.5 cents a pint; grade B bulk, 1.5 cents a quart.

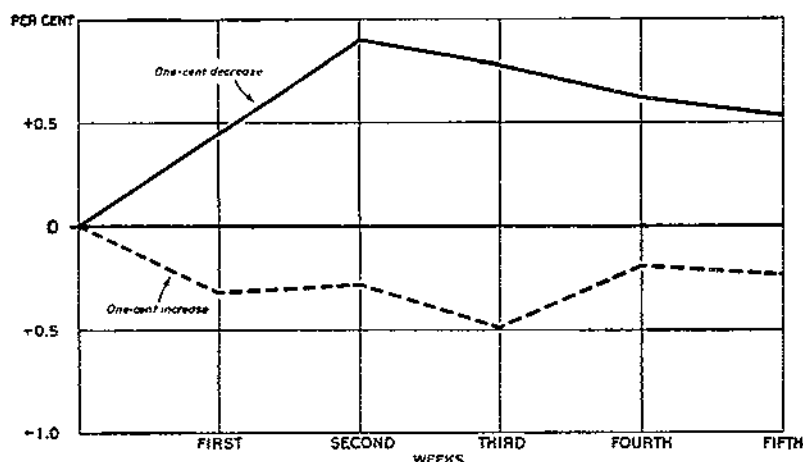


FIG. 34.—EFFECT OF A 1-CENT PRICE CHANGE ON RETAIL SALES OF QUARTS OF GRADE A AND GRADE B MILK, NEW YORK METROPOLITAN AREA, 1919-1924

Changes in sales expressed as percentages of the normal. When consumers are accustomed to a variable milk price, sales are very little affected by a 1-cent change in price

During the period of this study, 1919-1924, there were 13 increases and 14 decreases on the price of a quart of grade B milk. Other products also were subject to numerous price fluctuations. (Table 30.) Not all of these changes in price could be used in computing the effect on sales, because of the lack of comparable records during and following the milk-drivers' strike. A sufficient quantity of data is available, however, to show that the average curtailment of sales fol-



lowing a 1-cent advance in the price of quarts is almost negligible when consumers recognize the necessity of fluctuating milk prices. Similarly, the increase in sales following a 1-cent recession in price is barely noticeable. As might be expected, pint sales are affected to a greater extent by a 1-cent change because of the smaller quantity of milk represented. Even with this unit, a 10 per cent change in price causes only a 2 per cent change in demand.

Although the data are too variable and the effect on sales is too slight to be conclusive, there is some indication that the increases or decreases are not maintained for a very long period. (Fig. 34.) The measurement of sales was not carried further than the fifth week following the price change, because the frequent price fluctuations would have resulted in an overlapping of periods.

TABLE 30.—Prices of milk and cream on retail routes in New York City<sup>1</sup>

Date when prices became effective	Quarts of grade B milk	Quarts of grade A milk	Quarts of certified milk	Pints of grade B milk	Half pints of extra-heavy cream	Half pints of light cream	Half pints of condensed milk	Quarts of butter-milk
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
Prior to Nov. 1, 1907	8							
Nov. 1, 1907	9							
Aug. 18, 1916	9	11	16	6	15	10	8	6
Oct. 20, 1916	10	12	16	6	16	11	9	7
Feb. 1, 1917	11	12	16	6	18	12	10	7
June 1, 1917	11	12	18	6	18	12	10	7
July 1, 1917	11.5	12.5	18	6	18	13	11	10
Aug. 1, 1917	12.5	13.5	18	6.5	20	14	12	10
Oct. 1, 1917	14	15	20	7	21	16	13	10
Jan. 5, 1918	15	17	20	7	21	16	13	10
Feb. 1, 1918	14.5	16.5	20	8	21	16	14	10
Apr. 1, 1918	14	16	20	8	22	17	14	10
May 1, 1918	13	15	20	7.5	22	17	14	10
June 1, 1918	13	15	20	7.5	22	17	14	10
Sept. 1, 1918	14	16	20	8	22	17	14	10
Oct. 1, 1918	15.5	17.5	22	8.5	24	19	15	10
Oct. 15, 1918	16.5	17.5	22	9	25	19	15	10
Nov. 1, 1918	16	18	22	10	26	20	16	11
Nov. 14, 1918	17	19	23	11	27	21	17	11
Jan. 1, 1919	16	18	21	10	26	20	16	10
Apr. 1, 1919	15	17	21	9	25	19	15	10
July 1, 1919	16	18	21	9.5	26	19	16	11
Nov. 1, 1919	18	20	25	11	28	20	18	11
Feb. 1, 1920	16	19	25	10	28	20	18	11
Apr. 1, 1920	15	18	25	9	28	20	18	11
May 1, 1920	15	18	25	9	27	20	18	11
June 1, 1920	15	18	25	9	28	20	18	11
July 1, 1920	16	19	26	10	29	21	19	12
Aug. 1, 1920	17	20	27	10	30	21	19	12
Sept. 1, 1920	18	21	28	11	30	22	20	12
Dec. 1, 1920	17	20	28	11	30	22	20	12
Feb. 1, 1921	16	19	28	10	30	21	20	12
Mar. 1, 1921	16	18	28	9	29	20	19	11
June 1, 1921	14	17	26	9	28	19	17	11
Aug. 1, 1921	15	18	26	10	29	19	18	11
Apr. 1, 1922	14	17	26	10	28	18	17	10
May 1, 1922	13	16	25	9	28	18	17	10
July 1, 1922	14	17	26	10	29	19	18	10
Aug. 1, 1922	15	18	26	10	30	20	19	10
Dec. 1, 1922	16	19	28	10	32	22	21	10
Feb. 1, 1923	15	18	28	10	30	20	20	10
May 1, 1923	14	17	28	10	29	19	19	10
Sept. 1, 1923	15	18	28	10	29	19	19	10
Oct. 10, 1923	16	19	28	10	29	19	19	10
Nov. 12, 1923	15	18	28	10	29	19	19	10
Jan. 8, 1924	14	17	28	9	29	19	19	10
May 5, 1924	13	16	28	9	28	18	18	10
Aug. 18, 1924	14	17	28	10	29	19	19	10
Nov. 1, 1924	15	18	28	10	29	19	19	10
May 18, 1925	14	17	28	10	29	19	19	10
July 20, 1925	15	18	28	10	29	19	19	10

<sup>1</sup> Because of the longer haul and higher delivery cost on Staten Island and in some of the Queens and Long Island districts, retail prices there are from 1 to 2 cents per unit above the Manhattan and Brooklyn prices.

At one time the price of quarts of both grade A and grade B milk was advanced 2 cents. In both cases serious decreases in demand followed. A single instance can not be taken as conclusive, but it appears that the psychological effect on consumers of a 2-cent advance is sufficient to cause a material drop in sales. Coupled with the 2-cent increase, however, was the fact that the new price for grade B milk (18 cents) was the highest ever attained up to that time. During the next year the price receded to 15 cents and then advanced 1 cent at a time until 18 cents was again reached. The last advance to that figure was followed by a decrease of more than 5 per cent in the sales, indicating that 17 cents marked the upper limit to which the price could be raised without an appreciable decrease in demand. In a like manner, sales of grade B bulk milk and grade B pints fell off 10 and 14 per cent, respectively, when the price of each was increased  $1\frac{1}{2}$  cents.

From this study and from a somewhat similar one of the Chicago market,<sup>10</sup> it may be concluded that the demand for milk shows very little elasticity when the consuming public becomes accustomed to a retail price which changes occasionally. In other words, milk is recognized as an inexpensive and essential food, and if the costs of producing milk rise, the retail price can be advanced 1 cent at a time with very little effect on sales. Undoubtedly, however, there is a limit beyond which the price can not be advanced without a sharp fall in demand. These conclusions are intended to apply only to price changes within reasonable limits. Conversely, lowering the price does not greatly stimulate consumption. This is unfortunate, since a surplus of milk in the district can not be absorbed by the fluid market in this way. Such a surplus, in seeking to get on the city market, is likely to force down the retail price, but the final result is the consumption of approximately the same quantity of milk as before.

Obviously, retail milk prices should not fluctuate at short intervals, but a price which advances in the fall and recedes in the spring accustoms consumers to the idea of a variable milk price, so that consumption is practically unaffected when market conditions necessitate an advance in price. It was the lack of this system that was largely blamable for the disruption of the milk business in 1916, when public opinion delayed a price advance until decreased production and a milk strike forced a change.

#### OTHER FACTORS AFFECTING DEMAND

Numerous factors other than those discussed in the preceding pages affect the demand for dairy products. Most of these factors are irregular in their action, and sales rise and fall in a similarly irregular fashion. This is shown for retail sales of quarts and pints of grade B milk, half pints of extra-heavy cream, and pounds of butter in Figures 35 to 38. Secular trend, seasonal variation, and all short-time calendar and temperature fluctuations have been eliminated. The deviations in sales from the normal thus obtained are expressed in terms of standard deviation in order to make them comparable with similar curves of factors affecting demand.

<sup>10</sup> ROSS, H. A. THE MARKETING OF MILK IN THE CHICAGO DAIRY DISTRICT. Ill. Agr. Expt. Sta. Bul. 269: 503-510, 1925.

Various economic factors which might be supposed to influence sales of these products were studied. Many of them showed no correlation, some appeared to be affected by another factor which also affected demand, and a few showed a sufficiently high degree of

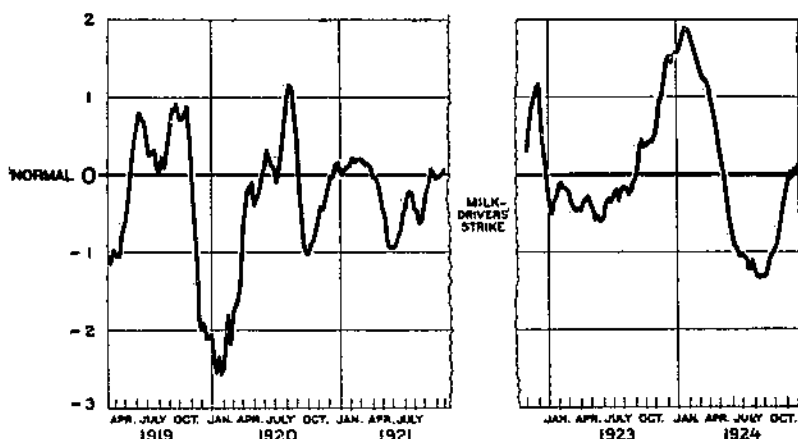


FIG. 35.—IRREGULAR VARIATIONS IN RETAIL SALES OF QUARTS OF GRADE B MILK, NEW YORK METROPOLITAN AREA, 1919-1924

Sales expressed in terms of standard deviation. This type of variation in sales of quarts of grade B milk appears due to business conditions, the relative price of bottled and bulk milk, and the relative price of milk and cream.

correlation to indicate that they influenced sales directly. The most important factors of the latter group are shown in Tables 31-34. The combined effect of the factors shown in the tables is indicated by the multiple correlation coefficient. Here, as in the

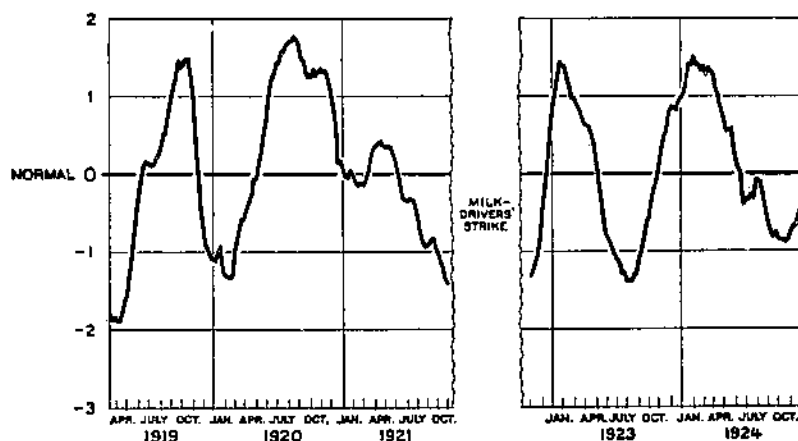


FIG. 36.—IRREGULAR VARIATIONS IN RETAIL SALES OF PINTS OF GRADE B MILK, NEW YORK METROPOLITAN AREA, 1919-1924

Sales expressed in terms of standard deviation. Pint sales seem to be most affected by the relative price of quarts and pints, and by the retail price of pints relative to the general price level.

case of the temperature correlations, perfect agreement would be expressed by a coefficient of 1. The net correlation coefficients show the degree of relationship between the sales and a given factor, when the effect of all the other factors is eliminated.

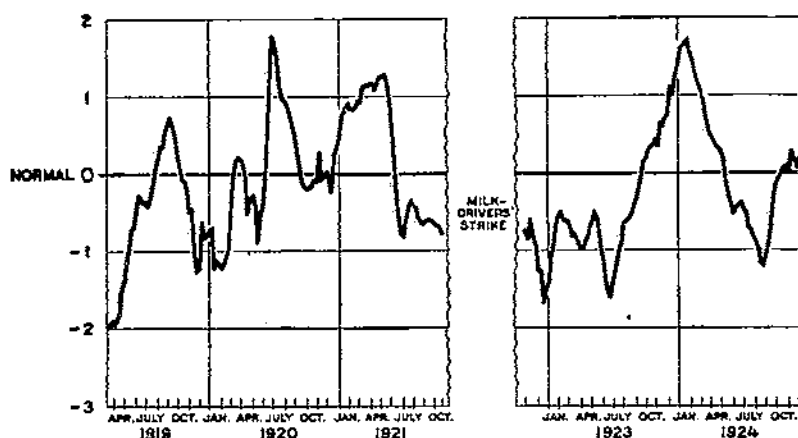


FIG. 37.—IRREGULAR VARIATIONS IN RETAIL SALES OF HALF PINTS OF EXTRA-HEAVY CREAM, NEW YORK METROPOLITAN AREA, 1919-1924

Sales expressed in terms of standard deviation. Business conditions, the relative price of cream and milk, and the retail price relative to the general price level, appear to be the chief factors affecting cream sales

TABLE 31.—Correlation between sales of quarts of grade B milk on retail routes in New York and various factors, 1919-1924<sup>1</sup>

Factor	Lag of sales in weeks	Net correlation coefficient	Probable error
Harvard (B) index of business conditions.....	43	+0.350	±0.040
Ratio of the retail price of cream to the retail price of milk.....	26	+ .101	± .044
Ratio of the retail price of bottled milk to the wholesale price of bulk milk.....	16	- .104	± .045
Temperature level relative to normal.....	0	+ .092	± .046
Combined factors (multiple correlation).....		.481	± .035

<sup>1</sup> Standard deviations of percentage deviations are, sales of quarts of grade B milk, 2.48; Harvard business index, 8.02; relative price of cream and milk, 3.03; relative price of bottled and bulk milk, 9.11; temperature, 10.05.

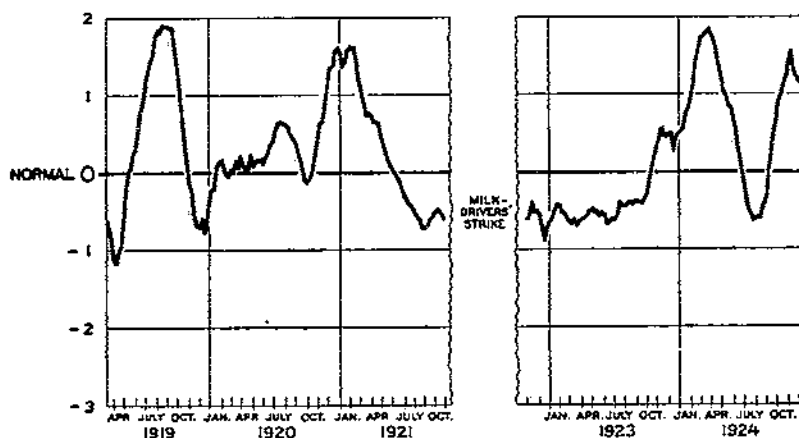


FIG. 38.—IRREGULAR VARIATIONS IN RETAIL SALES OF BUTTER ON MILK ROUTES, NEW YORK METROPOLITAN AREA, 1919-1924

Sales expressed in terms of standard deviation. Sales of butter are greatly affected by business conditions and by the relative price of butter and oleomargarine

TABLE 32.—*Correlation between sales of pints of grade B milk on retail routes in New York and various factors, 1919-1924*<sup>1</sup>

Factor	Lag of sales in weeks	Net correlation coefficient	Probable error
Ratio of the retail price of quarts of milk to the retail price of pints.....	6	+0.548	±0.030
Retail price of pints relative to general price level.....	6	-.372	±.037
Temperature level relative to normal.....	0	-.057	±.043
Combined factors (multiple correlation).....		.714	±.021

<sup>1</sup> Standard deviations of percentage deviations are, sales of pints of grade B milk, 7.48; relative price of quarts and pints, 3.85; price of pints, 5.56; temperature, 10.05.

TABLE 33.—*Correlation between sales of extra-heavy cream on retail routes in New York and various factors, 1919-1924*<sup>1</sup>

Factor	Lag of sales in weeks	Net correlation coefficient	Probable error
Harvard (B) index of business conditions.....	43	+0.582	±0.030
Ratio of the retail price of cream to the retail price of milk.....	21	-.225	±.044
Retail price of cream relative to the general price level.....	8	-.191	±.044
Combined factors (multiple correlation).....		.697	±.021

<sup>1</sup> Standard deviations of percentage deviations are, sales of extra-heavy cream, 4.86; Harvard business index, 8.62; relative price of cream and milk, 3.93; price of cream, 5.55.

TABLE 34.—*Correlation between sales of butter on retail routes in New York and various factors, 1919-1924*<sup>1</sup>

Factor	Lag of sales in weeks	Net correlation coefficient	Probable error
Harvard (B) index of business conditions.....	35	+0.546	±0.031
Ratio of the wholesale price of butter to the wholesale price of oleomargarine.....	4	-.205	±.043
Wholesale price of butter relative to the general price level.....	4	+.047	±.045
Combined factors (multiple correlation).....		.028	±.028

<sup>1</sup> Standard deviations of percentage deviations are, sales of butter, 7.11; Harvard business index, 8.62; relative price of butter and oleomargarine, 7.44; price of butter, 8.39.

In none of the products studied is the correlation sufficiently high to make accurate forecasting of sales possible, but all are high enough to indicate the trend of demand under a given set of conditions. They are of great importance in partly explaining the changes in demand and in refuting or proving some of the theories that have been advanced as to the causes of the changes. In connection with the following discussion, it should be borne in mind that the period covered by the study was one of great industrial prosperity, and that a similar study covering a long period of business depression might show different results. For this reason, too much weight should not be placed on the correlations given here.

Sales of grade A and certified milk showed so little variation of this type that no significant correlations were found. The demand for quarts of grade B milk appeared to be affected by the general business

conditions of the country as indicated by economic barometers. The one used here was the Harvard (B) index, in which bank debits in cities outside of New York City play an important part. The best correlation was shown by comparing the business index with sales of milk 43 weeks later.<sup>11</sup> That is, some months after increased business activity causes bank debits (deposits) to rise throughout the country, the demand for milk in New York City rises, presumably because of the increased prosperity of the people. Similarly, a slackening of business is reflected some months later by decreased demand.

A second factor affecting sales of quarts of grade B milk is the relative price of bottled and bulk milk. If the usual relationship between bottled-milk and bulk-milk prices is changed, enough people shift to the cheaper milk to affect sales. It apparently takes about 16 weeks for the full effect to be shown. A somewhat similar relation is shown by the relative prices of milk and cream. Apparently many families use the cream from the top of the milk bottles when the price of cream is high relative to the price of milk. When the price relation is reversed they buy bottled cream.

On the basis of this comparison only slight correlation was shown between temperature and sales of quarts of grade B milk. This particular factor was included to see whether deviations in temperature covering several weeks or months would be reflected in sales. The relation was unquestionably lessened by the inclusion of the winter months. Short-time temperature fluctuations and seasonal changes in temperature had already been eliminated.

Other factors which were studied but which showed less significant correlations were the retail price of milk relative to the general price level, earnings of New York factory workers, and the physical volume of manufactures.

Sales of pints of grade B milk appear to be materially affected by the retail price. Some six weeks after the price is high, relative to the general price level, sales of pints fall in number. The converse holds true when the retail price is relatively low. The largest factor in the demand is the relative economy of purchasing milk in pint or in quart bottles. Apparently people are more inclined to substitute one product for another when prices are out of line than they are to curtail consumption. This was found to hold true also in the sale of pints and quarts in Chicago.<sup>12</sup> Although the sale of pints is greatly affected by this tendency on the part of consumers, quart sales are not visibly affected because pints constitute such a small part of the total sales of bottled milk.

Retail sales of extra-heavy cream are more closely related to changes in the business activity of the country than to any other factor studied. As in the case of quarts of grade B milk, demand rises and falls with a lag of some months behind the Harvard (B) business index.

Since cream may be considered a semiluxury its sales are affected by price to a greater extent than is the household trade in milk. When the price is high relative to the general price level or to the retail price of milk, sales fall, indicating both substitution and actual curtailment of consumption.

<sup>11</sup> The author recognizes the danger of introducing errors in studies of this sort through the use of arbitrary lags. The lags used here, however, as well as the correlations obtained, appear reasonable, and the results are offered for whatever they may be worth.

<sup>12</sup> ROSS, H. A. THE MARKETING OF MILK IN THE CHICAGO DAILY DISTRICT. III. Agr. Expt. Sta. Bul. 200: 510-511, illus. 1925.

Butter sales on retail milk routes respond to almost the same factors as do cream sales. The highest correlation with business activity is shown when sales lag about 35 weeks behind the business barometer. Approximately equal degrees of relationship were found between sales of butter and the butter price, and between sales and the ratio of butter prices to oleomargarine prices. When both factors were included the net correlations indicated that the relative price of oleomargarine was the more important of the two. (Table 34.)

It appears from the foregoing correlations that the demand for cream and butter is affected to a greater degree by industrial prosperity and by price than is the demand for the more essential product, milk, and that the public tends more readily to substitute a cheaper product or package when prices are high than to curtail consumption. If the lags shown in Tables 30 to 33 are any indication, the speed with which this substitution occurs is proportional to the difference in price between the product and its substitute.

#### APPLICATION OF DEMAND DATA

In most cases, in this bulletin, specific commodities have been analyzed separately, so that it is possible to combine the sales of various grades or packages in any proportions desired. The whole group of producers in the New York milk shed are concerned primarily with the total demand for milk and cream, rather than with the demand for individual units. On the other hand, individual producers or cooperative groups who sell to one of the smaller dealers may have a market in which the demand may be unlike the average for the whole territory. Thus, a bulk-milk dealer requires relatively more milk to supply the demand in August than does a retail distributor of bottled milk.

Milk distributors, both large and small, are interested in the demand for specific products. They are interested also in the total demand for milk and cream as represented by their individual sales. Since the foregoing data are given in detail for various products, it is an easy matter to compute the weighted-average demand for the milk of any dealer.

The practical application of this study may be briefly summarized under the headings of the four aims stated in the introduction.

#### DETERMINATION OF FACTORS AFFECTING DEMAND

The steadily increasing population in the New York metropolitan area, and the increased per capita consumption since 1918, have resulted in a rapid rise in the demand for milk and cream. This increase may be attributed, in part, to the industrial prosperity of the city, which attracts people from other regions and provides a relatively high purchasing power for all the population. The latter factor is most evident in the rapidly increasing demand for grade A milk and for extra-heavy cream. The shift to the higher-quality product (grade A milk) and to the semiluxury (cream) is much more rapid than is the increase in the demand for all milk. This indicates that educational work as to the value of milk in the diet is needed to stimulate consumption, rather than a still greater buying power of the population.

Regular fluctuations in demand are caused by the vacation movements of persons to and from the city, seasonal changes in tempera-

ture, day-of-the-week variations, and holidays. Irregular fluctuations in demand may be due to short-time temperature changes, business conditions, unusually high or low retail prices, and relative prices of other products that may be substituted. The range in these types of fluctuations are shown for different products in Table 35. They are grouped in this way in order to show the relative importance of the various factors that cause the variations. It should be remembered, however, that the period of time between the maximum and the minimum demand differs for the various types of fluctuations. That is, the range for day-of-the-week variation may be the difference between Sunday and Monday sales, whereas for seasonal variation it may be the difference between January and July sales.

TABLE 35.—Comparable magnitude of various types of fluctuations in the sales of dairy products in the New York metropolitan area

Type of fluctuation	Range between the maximum and the minimum sales expressed as percentage of average or normal sales															
	Quarts of grade B milk		Quarts of grade A milk		Quarts of certified milk (retail)		Pints of grade B milk		Butter-milk		Extra-heavy cream		Light cream		Condensed milk	
	Retail		Retail		Retail		Retail		Retail		Retail		Retail		Retail	
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Seasonal	9	53	19	27	14	22	51	31	118	194	37	60	25	84	30	88
Day of the week	5	12	1	—	2	30	72	34	30	92	94	67	12	90	12	106
Holiday	9	—	0	—	6	31	—	33	—	—	91	45	—	—	—	—
Daily temperature <sup>1</sup>	2	12	1	—	2	12	13	23	23	59	—	—	—	—	—	—
Weekly temperature <sup>2</sup>	4	27	3	—	6	14	19	24	81	—	—	—	—	—	—	—
Business conditions, etc. <sup>3</sup>	10	—	16	—	30	—	17	—	24	—	20	—	—	—	—	—
Price change of 1 cent <sup>4</sup>	1	—	1	—	1	—	4	—	2	—	—	—	—	—	—	—
Price change of over 1 cent <sup>4</sup>	6	—	11	—	14	—	10	—	—	—	—	—	—	—	—	—

<sup>1</sup> From a 20 per cent decrease in temperature to a 20 per cent increase, or a range of 40 per cent.

<sup>2</sup> 4 times the standard deviation of sales.

<sup>3</sup> From a 1-cent decrease in price to a 1-cent increase, or a range of 2 cents in 2 price changes.

<sup>4</sup> Price of quarts of grade A and grade B increased 2 cents; price of pints of grade B and quarts of grade B bulk increased 1½ cents.

#### DETERMINATION OF THE QUANTITIES OF MILK AND CREAM WHICH PRODUCERS MUST SUPPLY

Although there is little hope that perfect adjustment between supply and demand in the New York milk market will ever be attained, some changes which will eliminate the present seasons of surplus and shortage appear to be necessary. The seasonal supply of milk can be changed more readily than can the demand, and the adjustment will therefore have to come about by making the production of milk during the shortage season sufficiently profitable to induce producers to change their present practice. The question of supply does not come within the province of this study, but the quantity of milk and cream that will be needed in the future can be computed rather accurately from the data on long-time trend and seasonal variation. It should be pointed out that a supply slightly in excess of the average requirement at any given period must be maintained to take care of the irregular fluctuations.



## FORMULATION OF A METHOD OF FORECASTING SALES

Prediction of sales on the basis of regular or calendar variations can be made as far in advance as is desirable. Obviously, the long-time forecasts will be less certain of fulfillment than will the short-time predictions, but the general method of applying these data is the same for all. In June, for instance, a dealer may wish to know what his demand will be in November in order to arrange for supplies to tide him over the shortage period. Taking his current sales as a base, he would increase or decrease them in proportion to the long-time trend of his business. Then from the proper seasonal-variation table he would find what percentage November sales were of June sales, and would correct for this factor. For a more immediate forecast he would correct for the day of the week and possibly for a holiday. Weather forecasts for the week would give him an approximation of the correction for the weather, while the daily temperature would serve as a guide for the bottling of the next day's milk.

Day-to-day predictions would be far more important than they are, were it not for the fact that dealers carry over a large amount of milk from one day to the next to cover the daily fluctuations. This stock of milk is not surplus, since it is sold as fluid milk or cream the next day. In addition to this, however, a certain amount of surplus in excess of the average sales must be carried. If demand can be forecast accurately, the amount of surplus will be decreased, less milk will be returned from retail routes, and less butter will be made in the city from milk that has paid a high freight charge.

## ANALYSIS OF DEMAND AS A FACTOR IN PRICE

Milk prices, like prices of other products, are subject to the law of supply and demand. A quantitative study, however, shows that there is little elasticity in the demand for milk so long as prices are kept within reasonable limits. For this reason, it is impossible to move a large amount of surplus milk into consumptive channels by lowering the price. On the other hand, a retail price which goes down 1 cent in the spring and up 1 cent in the fall, protects the interests of both consumers and producers. Under this system, the difference in the seasonal cost of production is more equitably distributed. Even more important than this is the fact that consumers, accustomed to occasional changes in the retail milk prices, do not materially curtail consumption if supply and demand conditions necessitate an advance. It was the lack of this system that was largely responsible for the disruption of the dairy industry in New York in 1916, when public opinion delayed a price advance until a milk strike and a decreased production eventually forced a change.

## APPENDIX

TABLE 36.—*Day-of-the-week variation in the retail sales of quarts of grade B milk in the New York metropolitan area, by districts, 1924*

District	Percentage of average sales for the week						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
<b>Manhattan:</b>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
1.....	92.9	102.5	101.9	102.2	102.2	102.1	96.1
2.....	96.2	102.4	101.0	101.4	101.3	101.8	95.9
3.....	98.7	101.5	103.2	101.7	100.6	101.3	98.0
4.....	100.5	100.3	100.0	100.0	99.7	99.7	99.8
5.....	102.5	99.9	99.2	100.7	98.9	99.8	99.0
<b>Bronx:</b>							
6.....	103.7	99.7	99.6	99.8	99.6	99.6	98.0
7.....	101.6	100.1	99.7	100.6	99.3	100.1	98.6
8.....	103.4	100.8	98.8	100.8	98.1	100.1	98.0
<b>Brooklyn:</b>							
9.....	104.6	100.4	98.9	100.1	99.1	99.3	97.6
10.....	103.7	99.6	100.1	99.9	99.0	99.4	98.3
11.....	104.5	99.5	100.3	99.4	98.4	99.7	98.2
12.....	107.9	98.9	98.8	99.7	98.2	99.9	98.6
13.....	104.7	100.0	99.4	100.2	98.6	98.3	97.8
14.....	103.5	99.8	99.5	99.6	98.2	99.2	98.2
15.....	108.6	98.3	98.3	98.6	98.9	97.4	98.9
16.....	103.8	99.7	99.5	99.6	99.2	99.3	98.9
<b>Queens:</b>							
17.....	108.6	98.1	99.3	99.1	98.2	98.4	98.3
18.....	102.8	100.0	99.9	100.4	99.1	100.3	99.9
19.....	106.3	99.5	99.2	99.5	98.1	98.9	98.5
20.....	108.5	98.1	99.4	98.2	98.4	97.6	98.9
21.....	108.4	97.8	99.3	98.6	99.7	97.3	98.9
22.....	106.2	97.3	99.2	98.7	99.7	98.7	100.2
23.....	108.3	98.5	98.7	99.3	98.2	98.5	98.5
<b>Staten Island:</b>							
24.....	107.9	97.2	98.2	99.1	98.1	97.6	101.0
25.....	104.2	98.3	99.2	99.6	99.6	98.1	101.0
26.....	103.0	98.7	98.8	99.5	97.6	98.8	103.0
<b>Westchester County:</b>							
27.....	100.7	99.3	99.3	99.8	100.1	100.4	100.4
28.....	104.3	99.2	100.4	99.2	98.8	98.7	99.4
29.....	104.8	98.1	99.3	99.3	99.5	98.8	100.2
30.....	99.9	99.7	98.7	99.4	98.1	100.5	103.7
31.....	93.4	99.1	99.4	100.1	99.5	99.2	104.3
32.....	101.3	99.0	100.1	98.3	100.1	99.0	102.2
<b>New Jersey:</b>							
33.....	104.0	97.2	100.7	98.5	99.8	98.0	100.9
34.....	104.2	98.4	99.4	100.1	99.3	99.3	99.3
35.....	103.6	99.2	99.8	100.0	99.8	100.4	98.2
36.....	103.7	100.0	98.9	100.5	99.3	100.3	97.3
37.....	105.0	97.0	99.7	99.3	99.6	98.0	100.5
38.....	102.2	99.5	100.1	100.0	99.9	99.3	99.0
39.....	105.7	99.1	99.0	99.8	98.5	99.0	98.9
40.....	104.5	98.6	99.0	100.2	99.1	97.1	100.8
41.....	107.4	97.1	99.2	99.0	99.4	97.0	105.5
42.....	102.2	97.1	99.1	99.3	98.9		
<b>Weighted average.....</b>	103.7	99.5	99.6	99.8	99.2	99.3	98.9

TABLE 37.—*Day-of-the-week variation in the retail sales of quarts of grade A milk in the New York metropolitan area, by districts, 1924*

District	Percentage of average sales for the week						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
<b>Manhattan:</b>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
1.....	97.9	101.0	100.7	100.7	100.8	100.6	98.3
2.....	96.2	101.7	101.0	101.5	101.0	101.2	97.4
3.....	95.8	101.4	100.3	101.2	100.1	101.0	100.2
4.....	100.4	99.9	100.2	100.2	100.0	99.9	99.4
5.....	100.3	99.9	99.8	100.8	99.5	100.1	99.6
<b>Bronx:</b>							
6.....	100.8	100.0	100.1	100.0	99.0	99.8	99.4
7.....	100.3	100.0	100.0	100.3	100.0	100.0	99.4
8.....	100.1	100.6	100.0	100.6	99.3	100.2	99.2
<b>Brooklyn:</b>							
9.....	100.8	100.3	99.7	100.3	100.0	99.7	99.2
10.....	100.7	99.8	100.2	100.0	99.0	100.0	99.4
11.....	100.2	99.8	101.0	100.0	98.7	101.3	99.0
12.....	101.3	100.0	100.0	100.3	99.3	99.6	99.5
13.....	100.9	100.2	100.1	100.5	98.7	100.5	99.1
14.....	100.0	100.4	100.0	100.2	100.1	99.0	99.4
15.....	101.1	99.8	100.4	100.0	99.2	99.7	99.8
16.....	100.2	100.4	99.9	100.2	99.8	100.2	99.3
<b>Queens:</b>							
17.....	101.3	99.7	100.1	100.1	99.5	99.7	99.6
18.....	100.1	100.4	100.4	100.6	99.7	100.2	98.6
19.....	101.3	100.3	100.4	100.1	99.0	99.8	99.1
20.....	102.1	99.6	100.1	99.6	99.5	99.1	100.0
21.....	101.7	99.3	100.3	99.8	100.0	99.3	99.6
22.....	102.5	97.5	100.4	99.0	100.8	99.4	100.4
<b>Staten Island: 23.....</b>	103.4	99.0	99.8	99.4	99.3	99.1	100.0
<b>Long Island:</b>							
24.....	103.1	98.4	99.8	99.5	99.7	98.6	100.8
25.....	99.4	100.2	99.7	100.6	99.0	100.6	99.6
26.....	100.7	99.8	100.4	99.4	98.4	99.8	101.5
<b>Westchester County:</b>							
27.....	101.2	99.8	100.0	100.0	99.5	100.0	99.5
28.....	100.7	100.0	100.3	99.8	99.6	99.8	99.8
29.....	101.4	99.0	100.5	99.8	99.4	99.5	100.4
30.....	100.8	99.3	100.0	99.9	98.8	99.8	100.4
31.....	99.8	99.8	100.1	99.9	99.5	99.7	101.2
32.....	100.0	98.8	100.3	99.5	100.4	99.4	100.6
<b>New Jersey:</b>							
33.....	100.9	99.2	101.1	99.3	100.9	99.0	99.6
34.....	102.0	99.4	100.1	100.3	99.2	99.5	99.5
35.....	102.0	99.8	99.8	100.0	99.5	99.6	99.3
36.....	99.8	100.5	99.6	101.1	99.6	100.9	98.5
37.....	104.7	98.2	99.5	99.7	98.7	97.7	101.5
38.....	101.6	99.5	100.2	100.1	99.5	99.5	99.6
39.....	101.1	99.6	100.2	100.1	99.6	99.6	99.8
40.....	99.1	100.1	100.0	100.8	99.7	100.5	99.8
41.....	102.3	98.8	100.0	99.6	99.8	99.0	100.5
42.....	101.3	98.6	99.3	99.6	99.0	99.3	102.9
<b>Weighted average.....</b>	100.5	100.0	100.2	100.3	99.8	99.8	99.4

TABLE 38.—*Day-of-the-week variation in the retail sales of quarts of certified milk in certain districts in the New York metropolitan area, 1924*

District	Percentage of average sales for the week						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
<b>Manhattan:</b>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
1.....	94.0	102.7	100.9	102.2	102.2	101.8	96.2
2.....	92.2	103.0	100.7	102.1	103.9	102.6	95.5
3.....	95.8	102.7	99.8	101.8	100.4	101.8	97.7
4.....	101.5	99.1	98.8	99.1	101.5	103.0	97.0
5.....	99.1	100.6	99.5	101.2	99.9	100.2	99.5
<b>Bronx:</b>							
6.....	99.9	99.9	99.9	99.9	100.4	100.0	100.0
7.....	99.5	100.1	99.5	100.1	101.2	99.5	100.1
8.....	99.4	100.8	100.1	100.5	99.5	100.1	99.6
<b>Brooklyn:</b>							
15.....	100.8	100.3	99.5	99.8	100.6	99.2	99.8
16.....	99.6	100.7	99.1	100.6	100.6	99.8	99.6
<b>Queens: 21.....</b>	99.0	100.3	99.9	99.4	100.3	99.9	100.3
<b>Staten Island: 23.....</b>	100.1	101.0	98.8	100.6	99.7	100.6	99.2
<b>Westchester County: 23.....</b>	99.9	99.5	100.2	99.5	102.2	99.5	99.2
<b>Weighted average.....</b>	98.9	100.0	99.8	100.6	100.6	100.3	98.9

TABLE 30.—*Day-of-the-week variation in the retail sales of pints of grade B milk in certain districts in the New York metropolitan area, 1924*

District	Percentage of average sales for the week						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Manhattan:	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
1.....	81.5	116.6	116.4	117.8	118.6	117.6	61.5
2.....	56.1	115.5	114.6	115.8	116.8	114.0	67.2
3.....	65.6	110.7	110.4	112.2	111.0	112.0	78.1
4.....	90.9	106.0	102.8	103.3	103.4	103.3	93.3
5.....	97.1	101.3	100.4	101.6	100.0	100.6	99.0
Bronx:							
6.....	84.1	104.8	105.6	105.5	107.0	105.2	87.8
7.....	91.2	103.8	102.0	102.5	103.1	102.0	94.5
8.....	93.8	102.5	100.5	102.3	100.6	102.3	98.0
Brooklyn:							
13.....	82.0	105.4	104.6	106.1	105.6	105.1	90.3
14.....	82.4	106.3	106.3	106.5	107.1	105.3	86.1
15.....	85.5	104.5	104.2	104.6	104.6	103.3	93.0
16.....	84.4	104.0	104.1	105.5	106.0	104.7	90.4
17.....	75.8	100.0	107.3	107.7	109.3	106.4	87.5
Queens: 21.....	81.2	105.6	104.4	105.2	104.6	105.0	94.0
Staten Island: 23.....	61.2	111.4	111.7	113.0	114.0	113.4	75.3
Long Island: 25.....	86.0	104.4	104.3	104.1	104.0	102.4	94.2
Westchester County: 28.....							
New Jersey:							
33.....	75.9	108.1	107.0	108.3	109.5	107.0	83.6
34.....	88.7	102.7	103.8	102.9	103.6	102.0	96.3
35.....	85.1	104.4	104.7	105.2	105.2	103.9	91.5
36.....	72.7	107.0	108.4	108.4	107.5	108.1	89.0
40.....	88.6	103.1	102.8	102.8	102.8	103.1	96.8
Weighted average.....	77.6	106.8	106.9	108.0	108.0	107.2	85.5

TABLE 40.—*Day-of-the-week variation in the retail sales of half pints of extra-heavy cream in certain districts in the New York metropolitan area, 1924*

District	Percentage of average sales for the week						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Manhattan:	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
1.....	90.8	102.9	102.2	102.5	97.0	96.0	98.7
2.....	103.4	90.9	86.9	94.2	85.2	88.2	91.2
3.....	120.5	94.3	93.7	99.1	92.3	93.8	97.3
4.....	161.8	85.2	63.0	95.2	89.4	88.2	97.2
5.....	145.0	90.1	92.0	96.7	90.5	89.2	95.6
Bronx:							
6.....	225.0	76.4	84.1	82.3	70.3	73.1	79.6
7.....	174.0	87.0	92.9	92.4	86.5	82.0	86.2
8.....	177.3	90.1	89.3	93.2	83.9	79.8	96.4
Brooklyn:							
10.....	184.7	84.3	91.4	90.7	86.1	78.0	84.8
11.....	230.7	74.2	84.2	84.5	78.8	69.7	77.9
15.....	164.2	90.3	93.6	93.8	88.0	80.2	89.3
16.....	261.0	64.6	76.2	81.2	75.2	65.5	75.4
Queens: 21.....	236.3	60.6	75.7	85.0	76.3	71.4	85.5
Staten Island: 23.....	102.7	76.7	87.2	87.2	83.5	80.4	92.3
Westchester County: 28.....							
New Jersey:							
34.....	194.2	74.2	87.6	90.0	87.6	77.8	88.6
37.....	192.0	76.6	85.4	91.1	83.6	78.7	92.0
40.....	203.9	71.7	85.4	86.0	83.3	73.2	95.6
Weighted average.....	176.3	83.4	88.8	92.3	86.2	82.1	90.9

TABLE 41.—*Day-of-the-week variation in the retail sales of half pints of light cream in certain districts in the New York metropolitan area, 1924*

District	Percentage of average sales for the week						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
<i>Manhattan:</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
1.....	66.0	120.9	110.4	116.4	111.9	114.9	66.5
2.....	91.4	102.6	101.7	105.2	103.4	100.9	94.8
3.....	96.3	103.3	100.2	101.8	98.7	98.7	101.0
4.....	107.4	98.2	98.2	107.4	94.4	100.0	94.4
5.....	102.1	97.0	98.2	102.5	97.0	96.4	99.8
Bronx: 8.....	116.7	97.0	99.5	103.3	94.2	93.7	95.0
<i>Brooklyn:</i>							
15.....	115.8	94.2	100.1	105.0	96.2	92.4	93.3
16.....	107.0	97.4	101.8	104.8	98.8	95.1	95.1
Queens: 21.....	123.1	91.9	97.6	105.0	95.2	93.6	93.6
Staten Island: 23.....	115.2	94.5	98.9	101.4	97.1	93.3	99.6
Westchester County: 28.....	119.9	93.3	99.0	98.0	95.9	95.4	96.5
New Jersey: 40.....	100.8	92.7	95.1	107.3	97.6	95.1	102.4
Weighted average.....	108.0	98.0	99.7	103.5	97.8	96.6	96.4

TABLE 42.—*Day-of-the-week variation in the retail sales of half pints of condensed milk in certain Manhattan and Bronx districts, 1924*

District	Percentage of average sales for the week						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
<i>Manhattan:</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
4.....	104.3	90.8	99.3	99.3	96.8	90.8	106.7
5.....	101.8	98.0	100.5	104.3	93.1	95.6	106.7
Bronx: 8.....	115.8	97.0	91.5	115.8	94.2	91.5	94.2
Weighted average.....	105.0	96.9	99.0	105.8	93.8	94.7	103.8

TABLE 43.—*Day-of-the-week variation in the retail sales of quarts of buttermilk in certain districts in New York City, 1924*

District	Percentage of average sales for the week						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
<i>Manhattan:</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
1.....	26.4	124.5	119.7	122.7	121.5	124.5	60.7
2.....	57.6	116.8	111.7	111.7	100.4	112.4	96.4
3.....	60.3	114.3	107.9	104.8	106.1	103.2	97.4
4.....	91.5	97.9	102.8	102.8	103.0	101.3	109.7
5.....	87.4	98.4	105.9	104.1	99.5	99.5	105.2
<i>Bronx:</i>							
6.....	87.8	97.1	103.6	102.5	104.2	99.3	105.5
7.....	87.1	102.0	105.9	103.0	104.0	103.9	92.1
8.....	88.5	105.9	104.6	104.9	98.3	99.4	96.4
<i>Brooklyn:</i>							
15.....	87.4	106.7	112.9	104.4	99.9	96.7	92.0
16.....	76.2	106.4	110.0	105.7	101.0	109.6	88.1
Staten Island: 23.....	86.7	103.3	103.2	101.7	99.6	107.5	96.0
Weighted average.....	76.4	106.0	106.5	106.3	102.9	106.5	94.5

TABLE 44.—*Day-of-the-week variation in the retail sales of quarts of Grade B milk in the New York metropolitan area, by months, 1924*

Month	Percentage of average sales for the week						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
January.....	104.3	99.4	99.4	99.3	98.9	99.3	99.4
February.....	101.5	99.2	99.1	99.9	99.0	99.0	101.3
March.....	104.7	99.2	99.1	99.7	98.9	99.1	99.3
April.....	104.8	99.4	99.2	99.5	98.7	98.9	99.5
May.....	104.6	99.2	99.7	100.1	99.6	99.8	98.6
June.....	102.8	99.2	99.7	100.5	100.0	99.7	97.8
July.....	101.7	99.7	100.6	100.1	99.8	100.2	98.7
August.....	102.2	99.8	99.2	99.8	99.3	99.3	98.5
September.....	102.9	100.1	100.1	100.0	99.3	99.1	99.1
October.....	103.6	99.1	99.8	100.0	99.3	98.8	99.1
November.....	104.2	99.7	99.1	99.0	99.2	98.8	99.1
December.....	104.7	99.2	99.1	99.0	99.2	98.8	99.1
Weighted average.....	103.7	99.5	99.6	99.8	99.2	99.3	98.9

TABLE 45.—*Day-of-the-week variation in the retail sales of quarts of grade A milk in the New York metropolitan area, by months, 1924*

Month	Percentage of average sales for the week						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
January.....	101.2	99.8	100.0	99.8	99.7	99.7	99.8
February.....	101.0	99.9	99.9	100.5	100.1	99.4	99.2
March.....	101.0	99.8	99.8	100.0	99.8	99.8	99.8
April.....	101.0	99.2	100.2	100.4	99.8	99.8	99.8
May.....	100.0	99.9	100.0	100.2	100.2	99.7	99.1
June.....	99.6	99.5	100.2	100.3	99.8	100.6	100.0
July.....	99.2	99.7	101.0	100.9	100.4	100.0	99.8
August.....	99.8	99.9	99.8	100.3	100.2	100.4	99.6
September.....	100.6	100.6	99.8	99.7	99.7	99.9	99.7
October.....	100.8	99.9	100.2	100.2	100.1	99.6	99.2
November.....	101.0	100.3	99.7	100.2	99.8	99.2	99.8
December.....	101.0	99.9	99.9	100.1	99.9	99.5	99.7
Weighted average.....	100.5	100.0	100.2	100.3	99.8	99.8	99.4

TABLE 46.—*Day-of-the-week variation in the retail sales of quarts of certified milk in the New York metropolitan area, by months, 1924*

Month	Percentage of average sales for the week						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
January.....	99.1	100.3	100.0	100.5	100.0	100.7	99.4
February.....	101.0	99.8	99.3	99.8	98.8	102.2	99.1
March.....	99.5	100.9	100.0	100.7	101.7	99.2	98.0
April.....	98.2	100.9	100.5	100.8	101.4	100.1	99.0
May.....	98.9	101.0	100.0	100.5	101.8	100.7	97.1
June.....	98.8	99.9	100.8	101.0	99.9	100.5	99.1
July.....	97.7	99.4	101.8	101.4	100.8	99.8	99.1
August.....	98.6	99.6	100.0	100.7	100.4	101.1	99.6
September.....	99.1	101.5	99.4	98.6	102.2	99.7	99.2
October.....	98.8	100.5	101.0	99.9	99.9	100.5	99.4
November.....	99.1	100.5	100.2	100.2	100.2	100.5	99.3
December.....	99.2	100.8	100.0	100.2	100.2	100.0	99.6
Weighted average.....	98.9	100.9	99.8	100.8	100.0	100.3	98.9

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TABLE 47.—*Day-of-the-week variation in the retail sales of pints of grade B milk in the New York metropolitan area, by months, 1924*

Month	Percentage of average sales for the week						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
January.....	80.5	106.0	106.1	106.6	106.3	106.3	87.0
February.....	80.0	100.9	106.4	106.6	106.5	100.4	87.2
March.....	78.7	107.1	107.0	107.6	107.0	100.2	80.4
April.....	77.8	108.0	107.2	108.2	107.1	105.4	80.3
May.....	70.8	108.1	107.8	108.1	107.7	107.3	84.2
June.....	75.6	107.3	107.9	108.9	107.3	106.3	84.7
July.....	74.1	108.6	106.4	109.2	108.8	106.0	81.9
August.....	74.2	109.4	107.0	108.8	106.3	108.6	83.1
September.....	76.0	107.6	108.4	108.7	107.7	106.1	83.6
October.....	78.3	103.0	107.0	108.1	106.4	106.2	86.1
November.....	80.1	107.5	100.9	108.9	106.3	107.4	86.9
December.....	80.6	101.0	107.2	107.2	100.0	107.1	87.0
Weighted average.....	77.1	106.8	106.0	108.0	108.0	107.2	85.5

TABLE 48.—*Day-of-the-week variation in the retail sales of half pints of extra-heavy cream in the New York metropolitan area, by months, 1924*

Month	Percentage of average sales for the week						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
January.....	104.3	84.7	91.5	92.7	87.8	84.0	94.1
February.....	173.4	83.0	89.3	92.5	86.7	83.1	92.0
March.....	175.6	82.3	89.4	91.8	86.3	81.9	92.7
April.....	182.1	81.0	88.8	90.8	85.0	81.4	90.0
May.....	193.8	79.7	87.0	89.0	82.9	79.8	87.8
June.....	190.6	81.0	87.5	89.6	83.1	79.8	87.8
July.....	179.7	81.8	90.5	91.1	85.8	82.2	88.3
August.....	179.7	81.8	90.5	91.7	85.8	82.2	88.3
September.....	171.7	80.4	89.0	90.2	88.7	83.0	91.0
October.....	170.1	83.0	90.3	93.2	88.1	84.1	91.2
November.....	165.6	87.3	90.3	93.4	88.4	81.8	92.2
December.....	167.9	83.0	89.9	97.3	86.5	82.1	92.4
Weighted average.....	176.3	83.4	88.8	92.3	86.2	82.1	90.9

TABLE 49.—*Day-of-the-week variation in the retail sales of half pints of light cream in the New York metropolitan area, by months, 1924*

Month	Percentage of average sales for the week						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
January.....	100.0	97.0	100.2	100.2	97.4	97.4	97.9
February.....	100.7	96.6	100.1	102.0	98.4	96.0	97.2
March.....	109.6	97.1	99.5	103.0	98.3	95.4	97.1
April.....	109.4	96.5	100.2	105.1	97.7	95.8	95.3
May.....	108.3	97.3	99.7	104.6	97.3	97.9	94.9
June.....	105.8	97.3	101.2	104.5	95.6	96.6	96.0
July.....	100.2	97.2	102.1	106.2	98.0	97.2	93.1
August.....	107.0	97.2	99.9	104.3	99.0	97.2	95.4
September.....	108.1	99.4	100.1	101.6	97.2	97.2	96.4
October.....	105.3	96.5	100.9	102.8	99.0	97.1	98.4
November.....	107.8	99.4	98.2	103.6	98.8	95.8	96.4
December.....	108.7	98.0	99.2	102.8	97.5	96.3	97.5
Weighted average.....	108.0	98.0	99.7	103.5	97.8	96.0	96.4

TABLE 50.—*Day-of-the-week variation in the retail sales of half pints of condensed milk in the New York metropolitan area, by months, 1924*

Month	Percentage of average sales for the week						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
January.....	106.3	95.0	97.2	106.3	91.1	97.2	106.3
February.....	104.1	98.0	96.6	104.1	93.5	96.5	105.6
March.....	111.0	97.1	94.1	111.0	91.0	92.5	103.3
April.....	112.0	95.8	99.1	105.6	91.0	94.2	102.3
May.....	106.2	96.2	99.5	107.8	92.9	94.6	102.8
June.....	100.0	98.1	100.0	109.3	92.6	92.6	107.4
July.....	103.8	96.5	101.2	109.1	90.5	95.8	101.1
August.....	104.3	101.3	92.3	113.2	92.3	95.3	101.3
September.....	110.6	99.4	99.4	94.8	97.1	94.8	103.9
October.....	101.4	95.6	107.2	101.4	97.5	95.5	101.4
November.....	104.0	93.3	99.7	101.8	101.8	93.3	106.1
December.....	105.3	94.4	103.1	105.3	96.6	94.4	100.9
Weighted average.....	106.0	96.9	99.0	105.8	93.8	94.7	103.8

TABLE 51.—*Day-of-the-week variation in the retail sales of quarts of buttermilk in the New York metropolitan area, by months, 1924*

Month	Percentage of average sales for the week						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
January.....	80.5	105.4	101.6	104.9	102.7	107.0	97.9
February.....	82.5	103.0	106.3	106.2	90.2	106.2	96.0
March.....	82.3	104.5	105.9	107.4	90.8	105.0	96.1
April.....	80.0	108.3	107.4	107.0	98.0	103.5	95.8
May.....	77.6	106.9	108.2	106.5	101.6	103.2	94.0
June.....	72.9	107.0	109.7	102.8	104.8	106.5	94.8
July.....	68.2	108.1	106.6	106.0	107.7	111.1	89.4
August.....	73.4	112.8	102.9	105.3	103.8	107.0	94.8
September.....	72.5	104.0	113.8	113.4	101.9	105.3	89.1
October.....	78.7	104.0	108.7	102.8	101.6	105.3	99.0
November.....	81.5	107.2	97.9	105.3	104.4	105.8	97.9
December.....	79.2	106.3	103.1	105.8	104.1	105.3	95.7
Weighted average.....	76.4	106.9	106.5	106.3	102.9	106.6	94.5

TABLE 52.—*Day-of-the-week variation in the wholesale sales of quarts of grade B milk in the New York metropolitan area, by months, 1924*

Month	Percentage of average sales for the week						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
January.....	97.3	101.3	100.1	97.7	96.8	109.7	106.1
February.....	96.7	98.9	98.7	99.6	98.7	101.1	106.3
March.....	95.9	99.2	98.5	98.6	96.4	102.4	106.1
April.....	93.7	99.8	99.9	100.4	96.0	101.8	105.4
May.....	93.6	99.6	100.2	98.4	100.0	101.5	106.7
June.....	90.4	97.2	102.2	103.7	104.2	100.0	101.4
July.....	87.4	97.5	100.0	99.9	105.4	107.8	102.0
August.....	89.0	100.8	97.1	97.0	103.3	106.1	104.7
September.....	91.1	98.2	105.3	103.9	98.7	100.5	102.3
October.....	92.0	101.6	106.6	98.5	100.0	101.7	104.4
November.....	95.2	103.5	101.3	99.0	96.0	96.8	104.2
December.....	93.8	100.0	100.2	102.0	98.4	101.6	104.0
Weighted average.....	92.8	99.4	100.8	99.6	100.8	102.2	104.4



TABLE 53.—*Day-of-the-week variation in the wholesale sales of pints of grade B milk in the New York metropolitan area, by months, 1924*

Month	Percentage of average sales for the week						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
January.....	50.4	117.3	114.8	114.1	109.2	116.3	77.9
February.....	51.1	115.5	115.0	115.0	113.5	115.5	74.4
March.....	48.3	116.9	118.8	118.0	116.4	111.0	73.7
April.....	48.2	113.5	117.0	116.6	115.8	115.7	72.7
May.....	45.9	117.6	116.9	117.5	115.3	116.7	71.1
June.....	43.4	113.0	118.2	118.7	125.4	115.7	65.6
July.....	38.2	116.1	117.6	118.0	122.8	125.0	62.3
August.....	43.1	119.4	116.9	115.3	119.7	121.7	63.9
September.....	43.7	118.4	116.0	120.1	119.0	117.3	67.5
October.....	50.4	109.2	117.0	115.1	114.4	115.4	78.5
November.....	62.1	118.2	107.7	112.2	120.5	109.5	70.8
December.....	53.7	115.3	114.8	113.8	118.7	109.2	74.5
Weighted average.....	46.8	115.2	118.8	115.7	118.4	115.9	71.2

TABLE 54.—*Day-of-the-week variation in the wholesale sales of grade B bulk milk in the New York metropolitan area, by months, 1924*

Month	Percentage of average sales for the week						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
January.....	74.6	108.5	103.8	103.8	102.3	107.1	99.9
February.....	74.4	108.0	102.9	104.6	102.9	107.4	99.8
March.....	73.5	108.4	102.0	104.0	103.4	107.8	100.3
April.....	75.6	108.1	103.1	102.9	101.6	106.6	102.1
May.....	74.0	107.5	103.8	103.8	101.4	107.2	102.3
June.....	71.8	107.6	105.0	107.1	104.8	106.8	90.9
July.....	71.3	105.3	101.4	102.3	106.9	110.2	100.6
August.....	73.1	106.0	98.5	100.7	106.2	112.0	103.5
September.....	73.6	106.1	107.7	106.3	104.4	104.8	100.1
October.....	74.4	107.2	102.5	105.0	102.3	107.0	101.6
November.....	74.5	108.8	101.8	104.1	104.3	106.4	100.1
December.....	74.4	108.0	103.4	104.0	105.5	105.9	98.8
Weighted average.....	73.5	107.3	103.1	104.2	104.3	107.2	100.4

TABLE 55.—*Day-of-the-week variation in the wholesale sales of extra-heavy cream in the New York metropolitan area, by months, 1924*

Month	Percentage of average sales for the week						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
January.....	78.4	95.3	80.8	83.7	82.5	116.1	137.2
February.....	79.5	105.8	84.3	89.2	83.6	109.0	138.0
March.....	74.3	107.3	84.3	87.2	82.4	117.7	146.8
April.....	79.7	100.6	82.8	80.1	81.0	118.2	148.6
May.....	74.2	102.6	92.3	91.9	77.2	134.9	146.9
June.....	74.3	119.6	96.0	97.1	83.3	107.2	122.5
July.....	59.7	105.7	87.2	92.6	103.5	115.8	134.6
August.....	71.3	104.5	70.0	92.0	95.8	123.8	136.6
September.....	70.6	108.8	103.2	80.9	72.4	109.7	145.4
October.....	73.0	123.9	90.5	88.8	80.7	104.3	147.0
November.....	70.4	96.0	80.3	94.2	80.2	112.0	148.0
December.....	77.0	94.7	80.3	103.1	82.4	103.3	140.2
Weighted average.....	72.9	107.7	88.9	91.4	86.6	112.2	140.3

TABLE 56.—*Day-of-the-week variation in the wholesale sales of light cream in the New York metropolitan area, by months, 1924*

Month	Percentage of average sales for the week						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
January.....	29.2	84.0	64.0	79.4	168.8	173.4	100.6
February.....	40.8	169.1	90.9	88.0	80.5	103.1	128.5
March.....	42.4	113.6	91.7	88.9	51.6	127.0	151.0
April.....	41.5	114.8	95.4	78.3	93.1	132.8	144.4
May.....	39.5	101.4	100.4	85.2	85.2	124.5	158.8
June.....	39.7	140.2	104.4	104.2	83.7	119.8	106.0
July.....	31.6	113.2	97.0	98.5	106.4	125.0	128.3
August.....	38.1	125.8	78.1	97.6	99.8	126.1	134.5
September.....	49.3	113.1	111.0	97.6	81.8	111.8	130.5
October.....	50.8	120.7	100.9	59.4	87.7	109.6	135.5
November.....	46.4	111.4	95.3	98.5	99.6	114.6	133.2
December.....	57.2	112.3	92.9	103.0	91.7	100.0	130.3
Weighted average.....	42.3	118.9	95.6	93.7	91.0	121.8	132.8

TABLE 57.—*Day-of-the-week variation in the wholesale sales of condensed milk in the New York metropolitan area, by months, 1924*

Month	Percentage of average sales for the week						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
January.....	50.3	86.7	73.6	91.5	90.4	155.3	152.2
February.....	59.8	94.6	77.4	89.2	92.0	139.7	147.9
March.....	43.5	115.2	70.5	80.7	47.1	143.6	164.4
April.....	48.8	125.3	80.0	77.8	75.7	143.3	151.1
May.....	46.1	100.7	91.9	94.4	82.7	132.3	157.9
June.....	46.1	142.9	100.4	100.6	77.0	121.7	114.3
July.....	33.6	114.2	87.6	85.0	104.2	132.2	133.3
August.....	43.3	115.3	69.6	97.6	95.0	140.5	138.7
September.....	44.6	114.4	109.4	93.3	62.1	121.8	134.4
October.....	45.6	140.7	80.1	91.4	64.5	109.4	161.3
November.....	37.2	90.1	70.7	104.4	81.3	130.9	179.4
December.....	45.9	93.8	81.3	108.7	76.3	125.9	167.6
Weighted average.....	42.7	114.5	80.9	93.4	83.6	130.6	148.3

TABLE 58.—*Day-of-the-week variation in the wholesale sales of buttermilk in the New York metropolitan area, by months, 1924*

Month	Percentage of average sales for the week						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
January.....	40.4	146.1	93.5	86.2	122.3	118.8	91.7
February.....	34.4	124.3	118.7	102.1	101.5	113.2	105.8
March.....	25.7	134.1	112.1	114.2	100.5	110.6	93.8
April.....	38.1	140.9	100.7	100.7	102.0	116.0	101.6
May.....	45.9	120.6	107.3	113.6	105.4	106.0	100.3
June.....	30.4	113.0	117.0	127.3	120.0	113.7	75.1
July.....	25.6	126.2	103.3	112.0	123.8	122.9	88.2
August.....	38.7	130.4	92.5	102.0	122.3	123.2	90.9
September.....	33.5	119.0	142.1	117.8	99.4	100.2	88.0
October.....	37.0	123.6	102.4	104.4	113.4	111.1	107.2
November.....	40.5	135.3	94.9	95.8	105.3	124.8	103.4
December.....	35.3	121.2	85.4	110.5	126.0	104.7	116.9
Weighted average.....	34.4	120.5	100.0	108.2	114.4	115.0	94.5

TABLE 59.—Effect of holidays on the retail sales of quarts of grade B milk in the New York metropolitan area, 1924

District	Change in sales <sup>1</sup>										
	New Year's Day	Lincoln's Birthday	Washington's Birthday	Easter	Pass-over week	Memorial Day	Fourth of July	Labor Day	Yom Kippur	Thanksgiving	Christmas
Manhattan:	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
1.....	-8.8	-5.9	-5.4	+0.0	-3.4	-7.6	-8.2	-12.6	-0.6	-9.0	-9.0
2.....	-7.7	-6.0	-8.2	+1.2	-1.1	-9.0	-8.2	-11.0	-1.2	-7.1	-6.5
3.....	-4.2	-3.0	-4.1	0	-1.2	-5.9	-7.0	-10.5	-0	-2.4	-3.0
4.....	-1.8	-0	-2.4	+1.8	+0	-1.8	-3.0	-4.7	-0	-0	-0
5.....	-0	+1.2	0	0	-1.8	-1.2	-2.4	-6.9	-0	+2.4	+3.7
Bronx:											
6.....	-0	-0	-0	+2.8	+1.4	-1.8	-3.6	-8.7	+3.0	0	+1.2
7.....	-1.8	-0	-0	+1.2	-3	-0	-2.4	-5.3	+1.2	0	+1.2
8.....	-0	-0	+0	0	-1.0	-0	-1.8	-0.6	0	+0	+3.1
Brooklyn:											
9.....	-0	-1.8	0	0	+0	-0	-3.0	-0.6	0	+3.0	+3.0
10.....	+0	-0	0	-0	-2.6	-0	-5.4	-3.0	0	+1.8	+3.7
11.....	(?)	-1.2	+0	+2.3	-0.5	-1.8	-3.6	-7.1	0	+1.8	+2.4
12.....	+3.1	0	+1.2	-0.5	-3.1	-1.2	-2.5	-5.4	-0	+6.1	+5.5
13.....	-3.0	-1.8	0	-2.2	-1.7	-2.4	-3.6	-7.7	0	+2.4	+3.0
14.....	-0	-0	-0	+1.7	-0	-4.2	-2.4	-5.9	+1.8	+1.2	+2.4
15.....	(?)	-1.2	0	+1.1	-2.3	+2.5	+0	-4.3	+0	+4.0	+0.1
16.....	-0	-1.2	-0	-2.3	-0	-1.2	-1.8	-5.9	+1.8	+1.8	+1.2
Queens:											
17.....	+3.7	-0	0	0	-1.9	-2.5	-3.0	-7.3	-0	+6.7	+0.8
18.....	-1.8	-1.8	-2.4	-0	-3.2	-3.0	-4.8	-14.8	0	+0	+1.2
19.....	(?)	-1.2	0	-0.5	-5.5	0	-1.2	-4.2	-1.2	+3.7	+4.0
20.....	+2.4	+0	+1.2	0	-4.1	+1.2	+1.2	-3.7	+0	+7.3	+7.9
21.....	(?)	+0	+1.0	-0.5	+1	0	-1.2	-0.1	-0	+5.4	+7.9
22.....	0	-1.8	0	-0	-2.3	+8.7	+4.7	+18.1	-0	+3.0	+4.3
Staton Island, 23.....	+1.2	0	-0	-0	-1.1	+1.8	+1.8	+0.2	+0	-3.7	+4.0
Long Island:											
24.....	+1.8	0	+1.2	-1.1	-1.1	+4.3	+5.5	+2.6	0	+6.1	+7.4
25.....	+0	-2.4	-2.4	+0	-1.0	0	+2.4	-3.7	+1.2	+3.6	+4.2
26.....	-4.3	-1.2	+5.5	+1.2	+1.9	+0	+4.3	+5.6	-1.8	+8.0	+4.0
Westchester County:											
27.....	-1.3	-1.2	-3.0	+0	-1.2	-1.8	-5.3	-7.2	0	0	+0
28.....	0	-0	0	-0	-2.6	-1.2	-3.0	-7.8	0	+4.2	+5.4
29.....	+4.2	+2.5	-0	+0	-2.3	0	0	-2.5	-1.2	+6.0	+8.5
30.....	-3.0	-1.2	-3.5	-0	-1.3	-3.0	+1.2	-1.8	-1.2	+5.5	+0
31.....	-1.8	-3.0	-0.0	+0	-2.5	-1.8	-4.8	-3.0	+0	+1.2	-3.0
32.....	-1.8	-3.0	-2.4	+1.2	-1.1	-1.8	-1.2	-1.8	0	-1.2	+0
New Jersey:											
33.....	+1.2	-1.2	-0	-0	-1.2	-0	-1.8	-3.7	+0	+3.0	+4.8
34.....	-1.2	-1.2	+0	0	-1.1	+1.8	-3.6	-6.7	-1.2	+3.0	+3.0
35.....	-10.8	-1.8	-8.5	0	-0	-10.3	-12.7	-19.2	+0	-12.0	-15.0
36.....	+0	-2.4	-0	0	-0	-3.0	-4.8	-7.2	0	+1.2	+4.2
37.....	0	-1.2	+3.1	+0	-0	+1.2	-1.8	-0	+2.4	+5.5	+5.4
38.....	-1.2	-0	-0	+0	-0	-0	-2.4	-0.6	0	+1.2	+2.4
39.....	+1.8	0	+0	0	+1	+0	-1.8	-5.5	-0	+0	+4.3
40.....	+2.5	-0	+1.2	-0	-2.7	0	-1.2	-3.7	-1.2	+3.0	+3.0
41.....	+0	-1.2	+1.2	+1.1	-0	+1.8	+3.0	-3.1	-0	+6.7	+6.7
42.....	+6.1	+2.5	+3.7	0	-1.8	-1.8	+2.5	+0	-0	+4.3	+9.8
Weighted av.....	-1.4	-1.2	-0	0	-1.5	-1.2	-2.4	-6.0	0	+0	+3.0

<sup>1</sup> Percentage change from the average corrected sales for the 3 days preceding and the 3 days following the holiday.<sup>2</sup> Average change for the week in percentages of the average corrected sales for the preceding and the following week.<sup>3</sup> Data not available.

TABLE 60.—Effect of holidays on the retail sales of quarts of grade A milk in the New York metropolitan area, 1924

District	Change in sales <sup>1</sup>										
	New Year's Day	Lincoln's Birthday	Washington's Birthday	Easter	Pass-over week	Memorial Day	Fourth of July	Labor Day	Yom Kippur	Thanksgiving	Christmas
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Manhattan:											
1	-4.2	-2.4	-1.8	+1.2	-0.3	-4.2	-5.4	-7.6	0	-2.4	-4.1
2	-5.9	-3.6	-4.2	0	-1.0	-5.9	-6.5	-9.9	-1.2	-4.7	-0.6
3	-6.5	-4.2	-4.8	-6	-1.2	-5.9	-8.3	-9.3	0	-2.4	-4.2
4	-1.2	-1.2	+3.0	+6	+4	-1.2	0	-4.1	+19.8	+6	0
5	-2.4	+6	-1.2	-6	-2.1	-1.2	-3.6	-7.1	0	+1.2	0
Brooklyn:											
6	-1.2	-6	0	0	-9	-6	0	-6.5	+6	+6	+6
7	-6.6	-6	0	-1.2	-2.2	0	-1.8	-5.3	-6	+6	-6
8	+21.7	0	0	-1.2	-3.5	-1.2	-2.4	-8.2	-1.2	+6	-6
Brooklyn:											
9	-2.4	-6	-1.2	-1.2	-6	0	-1.8	-4.8	-1.2	+6	+6
10	-1.2	0	0	-1.2	-1.7	+6	-1.8	+3.1	-1.2	0	+6
11	(?)	-1.8	-1.2	+1.2	-8.9	-1.8	-1.2	-5.4	-1.8	0	+6
12	-1.2	0	+6	-6	-3.3	-1.8	-2.4	-7.7	0	+1.2	+1.2
13	-1.2	-1.2	0	-4.0	-1.8	-2.4	-1.8	-7.1	-6	+6	+6
14	-1.8	-6	0	0	-3.0	-4.2	-1.2	-5.3	-6	-6	0
15	(?)	-1.2	0	+6	-2.4	+6.6	-6	-3.6	0	+1.2	+6
16	-2.4	-1.2	0	-6	+3.2	+6	-6	-5.3	+6	0	+6
Queens:											
17	-1.8	-1.2	0	+6	-2.8	-2.4	-6	-4.8	0	+1.8	+1.8
18	-3.0	-1.2	-1.2	-6	-3.2	-2.4	-5.3	-7.1	-6	-1.8	-6
19	(?)	-6	0	-1.2	-9.2	-6	-1.2	-5.3	0	+1.2	+1.8
20	+1.8	-1.2	+6	-1.2	-3.1	-6	-6	-1.8	-6	+1.8	+3.0
21	(?)	0	-1.8	-1.7	-1.3	-6	-1.8	-5.4	-1.2	+1.8	+2.4
22	-1.2	-6	+1.8	-1.8	-4.1	+6.9	+1.2	+19.3	0	-1.2	-1.2
Staten Island: 23	-1.8	0	0	0	-1.3	+1.2	-1.2	+6.0	0	+2.4	+6
Long Island:											
24	+1.2	+6	-6	0	-6	+3.1	+2.4	+5.6	-1.8	+6	+1.8
25	0	-6	-1.8	+6	-6	-1.2	-4.2	-3.6	-6	0	+6
26	-6	-6	+4.8	+6	+1	-6	0	+1.2	-1.2	+1.8	0
Westchester County:											
27	-6	+6	-1.2	-1.2	-1.3	-6	-6	-5.4	0	+1.8	+6
28	-6	-6	+6	-1.2	-2.2	-6	-3.0	-4.8	0	+1.8	+1.2
29	+6	+6	+6	-1.2	-1.6	+6	0	-6	0	+1.2	+3.6
30	0	-6	-3.0	0	-1	-2.4	+1.2	0	+6	+4.3	+3.6
31	0	+6	-1.8	+6	-2.1	-1.8	-6	-6	0	+6	+6
32	+1.2	-1.2	-1.8	+6	-5	0	-6	-1.2	-6	-1.2	-6
New Jersey:											
33	-4.1	-6	-2.4	+1.2	-3.3	-3.7	-2.4	-6.6	0	-2.3	+1.2
34	-1.2	-6	+6	0	-7	-2.4	-2.4	-8.9	0	+1.8	+1.8
35	-1.2	-1.2	+6	-6	+3	-2.4	-3.0	-7.1	-6	+6	+6
36	0	-1.8	-6	-1.2	-1.5	-3.0	-4.1	-6.5	0	0	+6
37	+2.4	+1.2	+1.9	+6	-4	+1.2	-6	-6.0	0	+7.3	+7.9
38	-1.2	+6	+6	+6	-1.1	0	-3.0	-4.8	-1.2	+1.2	+1.8
39	-6	0	-1.2	+6	-4	-6	-3.6	-6.0	-1.2	-6	+6
40	-4.8	+2.5	-1.2	-6	-2.0	-3.6	-3.0	-6.0	+6	-1.2	+6
41	-1.2	0	-6	-1.7	-2.0	+6	-6	-6	+6	+6	+1.2
42	+2.4	+2.5	0	0	-2.6	-1.2	+3.6	-3.7	+3.6	+3.0	+1.8
Weighed ave.....	0	-1.2	-6	-6	-1.4	-1.2	-2.4	-4.8	0	+6	+1.2

<sup>1</sup> Percentage change from the average corrected sales for the 3 days preceding and the 3 days following the holidays.<sup>2</sup> Average change for the week in percentages of the average corrected sales for the preceding and the following week.<sup>3</sup> Data not available.

TABLE 61.—Effect of holidays on the retail sales of quarts of certified milk in certain districts in the New York metropolitan area, 1924

District	Change in sales <sup>1</sup>										
	New Year's Day	Lincoln's Birthday	Washington's Birthday	Easter	Pass-over week	Memorial Day	Fourth of July	Labor Day	Yom Kippur	Thanksgiving	Christmas
<b>Manhattan:</b>	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
1.....	-10.1	-9.4	-8.8	+2.5	+2.1	-6.4	-9.6	-9.4	-1.8	-7.1	-7.2
2.....	-12.4	-6.5	-7.6	+7.7	-2.0	-1.8	-12.4	-17.8	0	-9.0	-11.1
3.....	-4.8	-4.2	-3.5	+6	-7	-5.8	-2.4	-15.9	+1.2	-3.0	-6.4
4.....	0	-7.4	-23.7	-0	+9	-1.7	+4.3	+5.6	+1.8	-1.2	0
5.....	-3.0	+1.8	-6	-1.2	-2.3	-6	-8.5	-7.7	-1.8	-1.2	+6
<b>Bronx:</b>											
6.....	-6	-1.2	0	+1.8	-4	-1.2	+2.5	-6.4	-3.0	+3.0	+1.2
7.....	-6	-6	+1.2	+2.4	-4.0	-6	-6	-6	-4.2	-6	-6
8.....	-3.0	-1.2	+3.0	-2.4	-3.1	-6	-1.8	-7.6	-6	0	-6
<b>Brooklyn:</b>											
13.....	(?)	0	-6	+1.8	-9.2	+6.7	+1.2	-3.0	-1.2	+1.2	+6
14.....	-1.2	-6	+1.2	+1.2	+1.2	-2.4	-1.8	-7.6	+6	0	-1.2
Queens: 21.....	(?)	0	-3.6	-3.1	-10.1	+2.4	-3.6	-6.5	-1.2	+6	-1.8
Staten Island: 23.....	-1.8	-1.2	-1.8	+6	+2.5	-2.4	-1.2	+3.0	+6	-6	+1.8
Westchester County: 28.....	-2.4	0	-6	-1.8	-3.2	-1.2	-1.2	-4.8	+1.2	-2.4	-2.4
Weighted ave.....	-3.0	-1.8	-2.9	0	-1.8	-1.2	-1.8	-6.5	-6	-1.2	-1.8

<sup>1</sup> Percentage change from the average corrected sales for the 3 days preceding and the 3 days following the holiday.<sup>2</sup> Average change for the week in percentages of the average corrected sales for the preceding and the following week.<sup>3</sup> Data not available.

TABLE 62.—Effect of holidays on the retail sales of pints of grade B milk in certain districts in the New York metropolitan area, 1924

District	Change in sales <sup>1</sup>										
	New Year's Day	Lincoln's Birthday	Washington's Birthday	Easter	Pass-over week	Memorial Day	Fourth of July	Labor Day	Yom Kippur	Thanksgiving	Christmas
<b>Manhattan:</b>	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
1.....	-47.2	-47.9	-48.7	-2.4	-1.4	-59.1	-60.4	-59.4	-10.1	-56.0	-55.3
2.....	-46.4	-41.8	-45.6	+1.1	-3.0	-47.7	-52.5	-53.8	-13.3	-47.5	-48.0
3.....	-39.8	-29.1	-34.6	+1.0	-3.6	-41.4	-43.8	-41.0	-11.1	-35.4	-39.5
4.....	-8.8	-8.7	-10.3	+2.7	-2.4	-13.8	-11.4	-12.1	+1.7	-11.0	-9.7
5.....	-4.8	0	-3.0	-1.2	-2.1	-5.3	-11.6	-9.4	-1.8	-6.0	-4.7
<b>Bronx:</b>											
6.....	-21.2	-16.1	-18.5	+2.2	-7.9	-10.0	-12.4	-13.8	-2.3	-17.9	-18.6
7.....	-3.6	-5.8	-4.1	+3.8	-3.5	-7.7	-25.1	-11.8	+6	-8.2	-4.2
8.....	-6.0	-2.4	-1.2	-6	-2.1	-5.8	-10.3	-12.1	-6	-3.0	-7.1
<b>Brooklyn:</b>											
13.....	-18.9	-14.3	-15.8	+7	-2.7	-18.6	-20.8	-24.2	-4.5	-21.5	-19.9
14.....	-24.0	-22.2	-20.8	+11.6	-12.3	-24.6	-12.6	-15.1	-14.7	-21.1	-17.7
15.....	(?)	-7.5	-7.5	+5.1	-5.2	-13.2	-6.9	-16.2	-6.9	-15.8	-16.3
16.....	-10.9	-12.4	-12.6	+14.1	-9	-10.9	-15.3	-17.4	-6.2	-18.2	-17.3
Queens: 21.....	(?)	-8.1	-10.9	-8	-3.1	-28.1	-31.9	-35.4	-4.2	-24.7	-24.7
Staten Island: 23.....	-19.1	-13.7	-13.3	0	-2.9	-26.5	-28.9	-22.9	0	-21.6	-18.0
Long Island: 25.....	-37.9	-36.1	-37.4	+2.2	-2.2	-48.0	-44.7	-46.4	-5.2	-45.0	-50.3
Westchester County: 28.....	-9.0	-6.9	-7.1	-1.4	-1.7	-12.3	-14.0	-18.0	-1.0	-16.4	-14.3
<b>New Jersey:</b>											
33.....	-26.5	-19.9	-20.0	0	0	-20.0	-24.6	-31.6	+6.9	-25.9	-22.0
34.....	-9.6	-2.0	-6.5	-2.0	-9	-13.1	-18.5	-18.2	-1.7	-11.0	-12.1
35.....	-15.4	-6.9	-12.7	+1.4	-1.4	-15.9	-19.4	-24.2	-6	-18.4	-20.7
36.....	-24.4	-12.0	-16.7	0	-2	-25.7	-31.1	-36.3	-5	-25.7	-28.1
40.....	-10.4	-3.4	-8.0	+1.4	-2.9	-8.1	-9.1	-9.8	0	-8.7	-11.9
Weighted av.....	-24.0	-18.4	-20.7	+1.6	-2.6	-23.5	-28.3	-29.8	-5.5	-25.1	-26.1

<sup>1</sup> Percentage change from the average corrected sales for the 3 days preceding and the 3 days following the holiday.<sup>2</sup> Average change for the week in percentages of the average corrected sales for the preceding and the following week.<sup>3</sup> Data not available.

TABLE 63.—*Effect of holidays on the retail sales of extra-heavy cream in certain districts in the New York metropolitan area, 1924*

District	Change in sales <sup>1</sup>										
	New Year's Day	Lincoln's Birthday	Washington's Birthday	Easter	Pass-over week <sup>2</sup>	Memorial Day	Fourth of July	Labor Day	Yom Kippur	Thanksgiving	Christmas
<b>Manhattan:</b>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
1.....	+5.7	+1.1	-8.8	+4.6	-8.6	-10.8	-11.0	-12.6	-9.5	+0.6	-42.5
2.....	+37.3	+2.1	+7	+5.9	+1.2	-7	-8.1	-11.0	0	+55.0	+83.9
3.....	+14.0	-1.3	-1.3	0	-5	-5.8	-10.1	-15.0	+2.5	+16.9	+34.8
4.....	+30.8	+2.0	+0.8	+5.8	-0	-2.8	-3.4	-20.1	-1.3	+49.1	+53.6
5.....	+30.7	+4.7	+7.5	+1.1	-8	+10.4	+0.7	-6.3	-10.0	+64.7	+59.2
<b>Bronx:</b>											
6.....	+42.4	+2.1	+5.0	+1.0	+1.3	+15.8	+17.0	-18.2	0	+91.8	+137.8
7.....	+40.6	-7.1	-2.2	+3.2	+3	+3.1	+18.8	-16.6	-1.9	+103.8	+102.9
8.....	+40.4	-7	+11.7	+4.9	-1	+26.0	+10.2	-15.2	0	+68.3	+105.1
<b>Brooklyn:</b>											
10.....	+52.6	-3.3	+10.0	+8.2	-8	+30.6	+41.6	-3.5	+4.3	+111.0	+123.1
15.....	(2)	+2.2	+35.1	+20.1	+2.3	+53.3	+47.1	-11.7	-7	+199.3	+240.9
16.....	+33.5	-7.6	+13.0	-47.8	-17.7	+27.6	+14.7	-20.5	-4.6	+90.8	+129.5
Queens: 21.....	(2)	+5.4	+44.7	+10.6	+7.9	+85.9	+106.7	+17.4	-7	+230.1	+300.9
Staten Island: 23.....	+135.8	+18.7	+41.2	+10.6	+2.3	+85.7	+89.4	+21.4	-3.6	+263.3	+200.8
Westchester County: 28.....	+59.2	+8.6	+10.4	+7.3	+5	+31.2	+34.8	-7.0	-5.5	+119.9	+138.0
<b>New Jersey:</b>											
34.....	+62.1	+1.4	+15.6	+4.6	+2.4	+36.7	+49.6	-8.3	-2.6	+111.6	+141.1
37.....	+69.0	+8.7	+21.4	+6.2	+2.8	+48.8	+56.6	+10.3	-2.0	+102.8	+124.2
40.....	+94.5	-12.9	+14.9	+10.8	+2.0	+42.6	+54.7	-4.0	+2.1	+137.8	+175.5
<b>Weighted av.....</b>	<b>+44.0</b>	<b>+2.1</b>	<b>+11.1</b>	<b>+2.8</b>	<b>-6</b>	<b>+23.3</b>	<b>+27.8</b>	<b>-7.8</b>	<b>-1.0</b>	<b>+83.4</b>	<b>+83.7</b>

<sup>1</sup> Percentage change from the average corrected sales for the 3 days preceding and the 3 days following the holiday.<sup>2</sup> Average change for the week in percentages of the average corrected sales for the preceding and the following week.<sup>3</sup> Data not available.TABLE 64.—*Correlation between the weekly average maximum temperature and the weekly average sales of milk, by months<sup>1</sup>*

Month	Correlation between temperature and sales of—							
	Quarts of grade B milk		Quarts of grade A milk		Pints of grade B milk		Grade B bulk milk	
	Correlation coefficient	Probable error	Correlation coefficient	Probable error	Correlation coefficient	Probable error	Correlation coefficient	Probable error
April.....	+0.225	±0.134	+0.682	±0.003	+0.285	±0.129	+0.345	±0.140
May.....	+0.518	±0.105	+0.325	±0.120	+0.308	±0.130	+0.577	±0.106
June.....	+0.369	±0.130	+0.450	±0.117	+0.313	±0.140	+0.500	±0.136
July.....	+0.258	±0.137	+0.255	±0.138	+0.445	±0.118	+0.560	±0.123
August.....	+0.590	±0.094	+0.065	±0.154	+0.256	±0.134	+0.727	±0.075
September.....	+0.502	±0.093	+0.279	±0.123	+0.225	±0.137	+0.700	±0.061
All 6 months....	+0.348	±0.052	+0.218	±0.050	+0.273	±0.055	+0.470	±0.052

<sup>1</sup> Maximum temperature corrected for seasonal variation. Sales of milk corrected for secular trend, seasonal variation, and holiday variation. Both expressed as percentage deviations from the average for the preceding 3 weeks. Perfect agreement between temperature and sales would be expressed by the correlation coefficient +1.

TABLE 65.—*Correlation between the maximum temperature on a given day and the sales of milk on the following day, by months*<sup>1</sup>

Month	Correlation between temperature and sales of—							
	Quarts of grade B milk		Quarts of grade A milk		Pints of grade B milk		Grade B bulk milk	
	Correlation coefficient	Probable error	Correlation coefficient	Probable error	Correlation coefficient	Probable error	Correlation coefficient	Probable error
April.....	+0.176	±0.119	+0.396	±0.164	+0.572	±0.083	+0.421	±0.101
May.....	+0.400	±0.102	+0.060	±0.121	+0.258	±0.113	+0.803	±0.043
June.....	+0.438	±0.100	+0.247	±0.116	+0.421	±0.101	+0.697	±0.063
July.....	+0.500	±0.078	+0.424	±0.100	+0.520	±0.087	+0.088	±0.064
August.....	+0.680	±0.065	+0.485	±0.063	+0.404	±0.101	+0.814	±0.041
September.....	+0.195	±0.118	-0.171	±0.120	+0.189	±0.119	+0.606	±0.063
All 6 months...	+0.357	±0.044	+0.200	±0.048	+0.357	±0.044	+0.606	±0.032

<sup>1</sup> Maximum temperature corrected for seasonal variation. Sales of milk corrected for secular trend, and for seasonal, day-of-the-week, and holiday variations. Both expressed as percentage deviations from the average for the preceding 7 days. Perfect agreement between temperature and sales would be expressed by the correlation coefficient +1.

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