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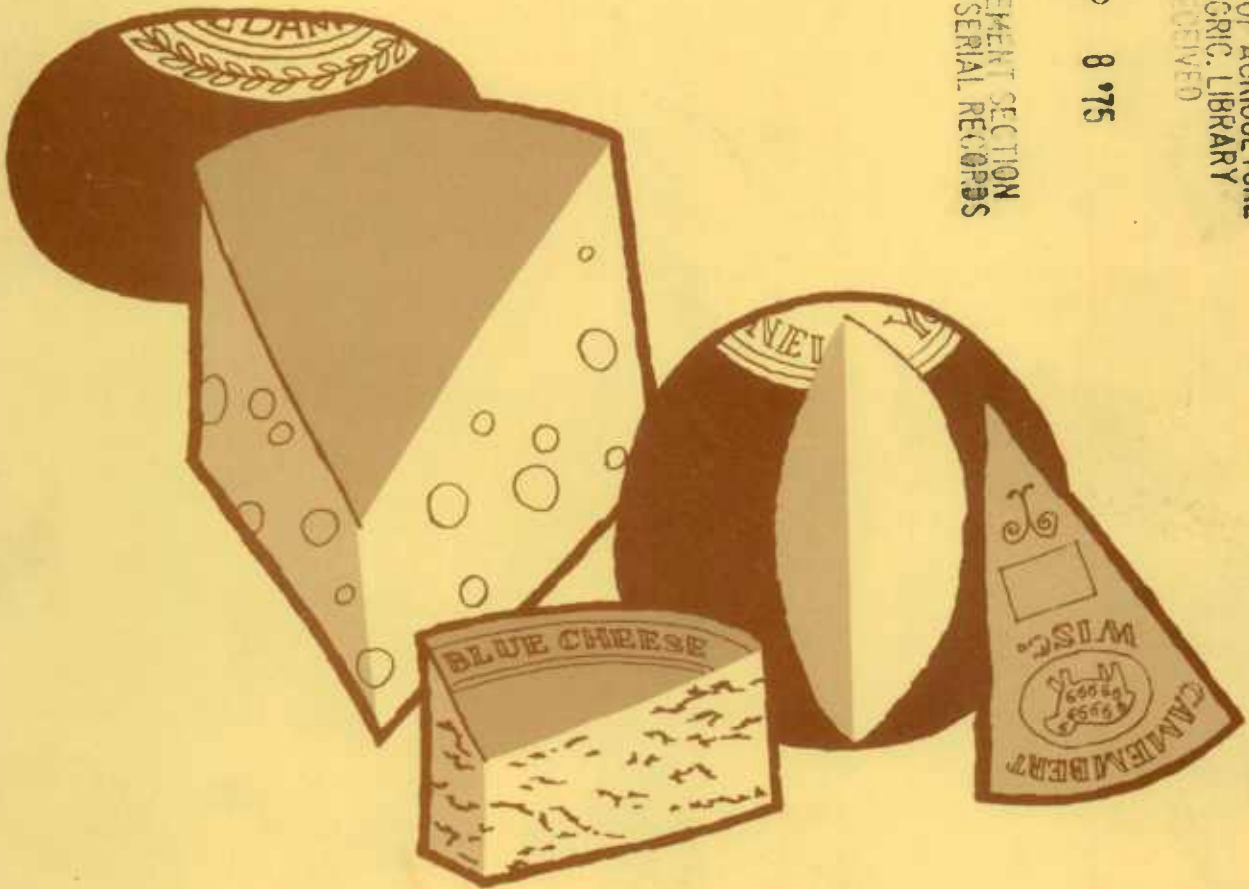
THE CHEESE INDUSTRY



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REPORT NO. 294

THE CHEESE INDUSTRY. By Harold W. Lough. Economic Research Service,
U.S. Department of Agriculture. Agricultural Economic Report No. 294.

ABSTRACT

The structure and organization of cheese manufacturing and distribution are described. Emphasis is placed on factors affecting the industry such as Government regulation, economic signals, technology, dairy business policies, and competing products, and on special areas of concern such as whey disposition. Trends in production, imports, stocks, and prices are included. Results of a national sample survey of 225 cheese plants are presented.

Keywords: Cheese, production, distribution, structure, organization, pricing, whey.

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SUMMARY

Natural cheese production in the United States increased 82 percent from 1960 through 1973. The greatest increase was in Italian-type cheese, primarily Mozzarella. This production increase was achieved despite a decline in the total number of plants from 1,419 in 1960 to only 865 in 1973. Average production per plant tripled during this period to 3.1 million pounds.

Natural cheese production is still heavily concentrated in the North Central Region near the source of large milk supplies, but some cheese is manufactured in every area of the United States.

The natural cheese industry involves many different types of manufacturers and channels of distribution. Corporations manufactured 59 percent of the total natural cheese in 1973; cooperatives, 33 percent; and individual proprietors and partners, only 8 percent. From the manufacturer, cheese usually moves through integrated intermediate distributors and cheese processors to final distribution.

There are many different forms and styles of natural cheese for each cheese type or variety. One-third of American-type cheese was manufactured in 40-pound blocks in 1973 and over half was in bulk (500-pound barrels and 640-pound blocks). Cheese was stored at the plant for "aging" an average of 20-50 days for American-type, 180 days for hard Italian-type, and 60 days for Swiss.

Whey disposition methods are changing in response to changing farming methods, pollution standards, and economic values. In 1973, over half of the whey was further processed by cheese manufacturing plants, less than a fourth was sold for further processing, and the rest was either fed to livestock or disposed of.

THE CHEESE INDUSTRY

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INTRODUCTION

This report describes the manufacture and distribution of the principal types and varieties of natural cheese. Both the nature of the businesses involved and the operations performed in arriving at the final cheese products are examined.

The description of the businesses includes their structure and organization and many of the factors which affect them, such as Government regulation, economic signals, technology, dairy business policies, and competing products. The discussion includes cheese manufacture, storage, transportation, exchange, and product standardization. Sources of information include previous reports, personal interviews with industry representatives, and a survey of cheese manufacturing plants conducted in April 1974.

Natural cheese production in the United States in 1973 totaled 2.685 billion pounds (18). 1/ Many varieties of natural cheese are manufactured in the United States, each with distinctive flavor, body, and texture. For convenience throughout this report, certain varieties are included under group headings. The principal group or type of cheese is American, which includes the specific varieties Cheddar, Colby, Granular, Stirred curd, Washed curd, and Monterey Jack. This group accounted for 62 percent of total U.S. cheese production in 1973. Cheddar accounts for over 78 percent of American-type production.

The Italian group includes the varieties Mozzarella, Ricotta, Provolone, Parmesan, and Romano. This group accounted for over 21 percent of total U.S. cheese production in 1973, of which two-thirds was Mozzarella.

All other cheeses referred to in this report are specific varieties. The Swiss cheese variety was 6 percent of total production in 1973 and the Cream cheese variety was 5 percent. Other varieties, primarily Blue, Brick, Limberger, Muenster, and Neufchatel, accounted for the remaining 6 percent of production. Cottage cheese is not covered in this report.

Natural cheese is distributed through several alternative market channels. However, more differences occur among the types of businesses handling distribution and the functions they perform than among the types or varieties of cheese. The same business may handle different cheese types or varieties.

Natural cheese is treated as a single industry in this report. In practice, however, manufacture of cheese and other dairy products, especially fluid milk, butter,

1/ Underscored numbers in parentheses refer to items in Literature Cited, p. 44.

and nonfat dry milk, are closely interrelated through relative prices, Federal programs, manufacturing flexibility among manufactured dairy product plants, and the fluid and manufactured dairy product policies of corporate and cooperative businesses. These make it difficult to study any dairy product separately. Although these factors are acknowledged in this report, they are difficult to quantify and will be given only brief attention.

TRENDS

Milk Utilization

Final dairy products, including fluid milk, cheese, butter, ice cream, and others, competed for milk supplies. Cheese production is utilizing an increasing proportion of milk in relation to most other manufactured dairy products. Total milk supply from 1960 through 1973 ranged from 115.4 billion pounds to 127.0 billion pounds. About half was utilized for all manufactured dairy products (fig. 1). During this same period, the proportion of total milk used for the manufacture of cheese almost doubled from 11 to 20 percent. Cheese production utilized a record 23.2 billion pounds of milk in 1973.

Production

Natural cheese production increased 96 percent from 1960 through 1974 (tables A.2-A.7). Almost half of this increase came during 1971-74.

Although production increased for all cheeses, the rate of increase varied among types and varieties (fig. 2). The greatest percentage increase was in Italian-type cheese, where production in 1974 was over 3.8 times greater than in 1960. American-type cheese also showed a large increase, with production in 1974 up 84 percent from 1960. The two other major cheese varieties, Swiss and the combination of Cream and Neufchatel, increased 50 and 37 percent, respectively.

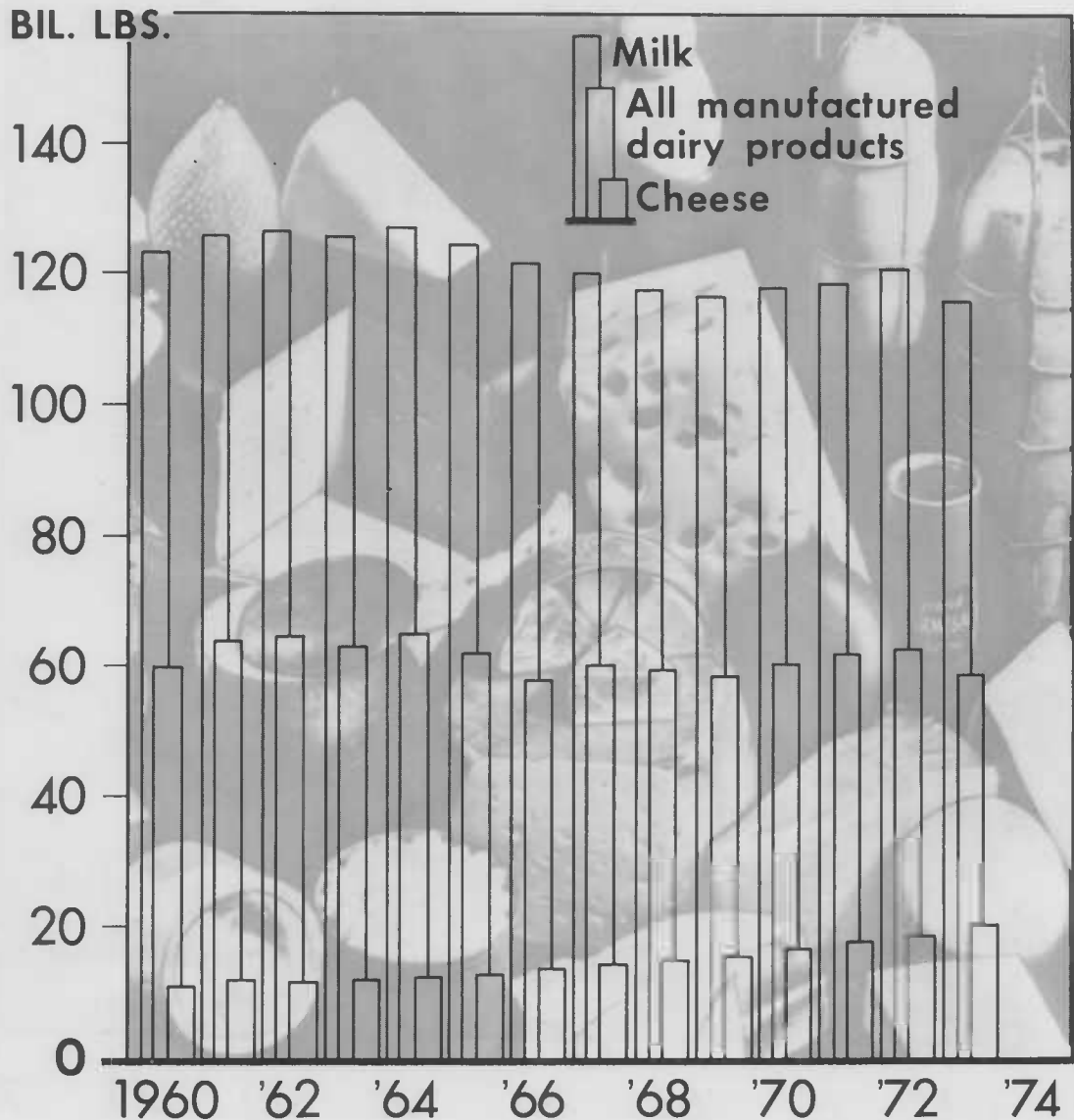
Natural cheese production is highly seasonal since it depends on fluctuating milk supplies. In recent years it has been highest during the summer months of the flush milk season, generally declining in late June through November, and increasing in December through mid-June. American-type and Swiss cheeses have followed this general seasonal production pattern, with the highest production in the summer and the lowest in the spring and winter. Italian-type cheese production has also peaked in summer, but production has been lowest in the fall and has generally risen through the winter and spring. In contrast, Cream and Neufchatel cheeses combined have had the highest production in the winter with relatively lower production during the other seasons, due to the heavy seasonal demand during the winter holidays.

A large proportion of natural cheese is further processed into pasteurized process cheese products. Production of process cheese was 720.7 million pounds in 1973, one-fourth of the production of natural cheese (natural equivalents). ^{2/} Production of process cheese foods, spreads and cold pack was 441.8 million pounds in 1973, or about 11 percent of total natural cheeses produced (natural equivalents).

The production of process cheese increased about 60 percent from 1960 to 1973 (fig. 3), and output of process cheese foods, spreads, and cold pack about doubled

^{2/} Natural equivalent is the pounds of natural cheese used to produce cheese processed products. There is approximately 0.9 pound of natural cheese in 1 pound of process cheese and approximately 0.65 pound of natural cheese in 1 pound of process cheese foods, spreads, and cold pack cheese food.

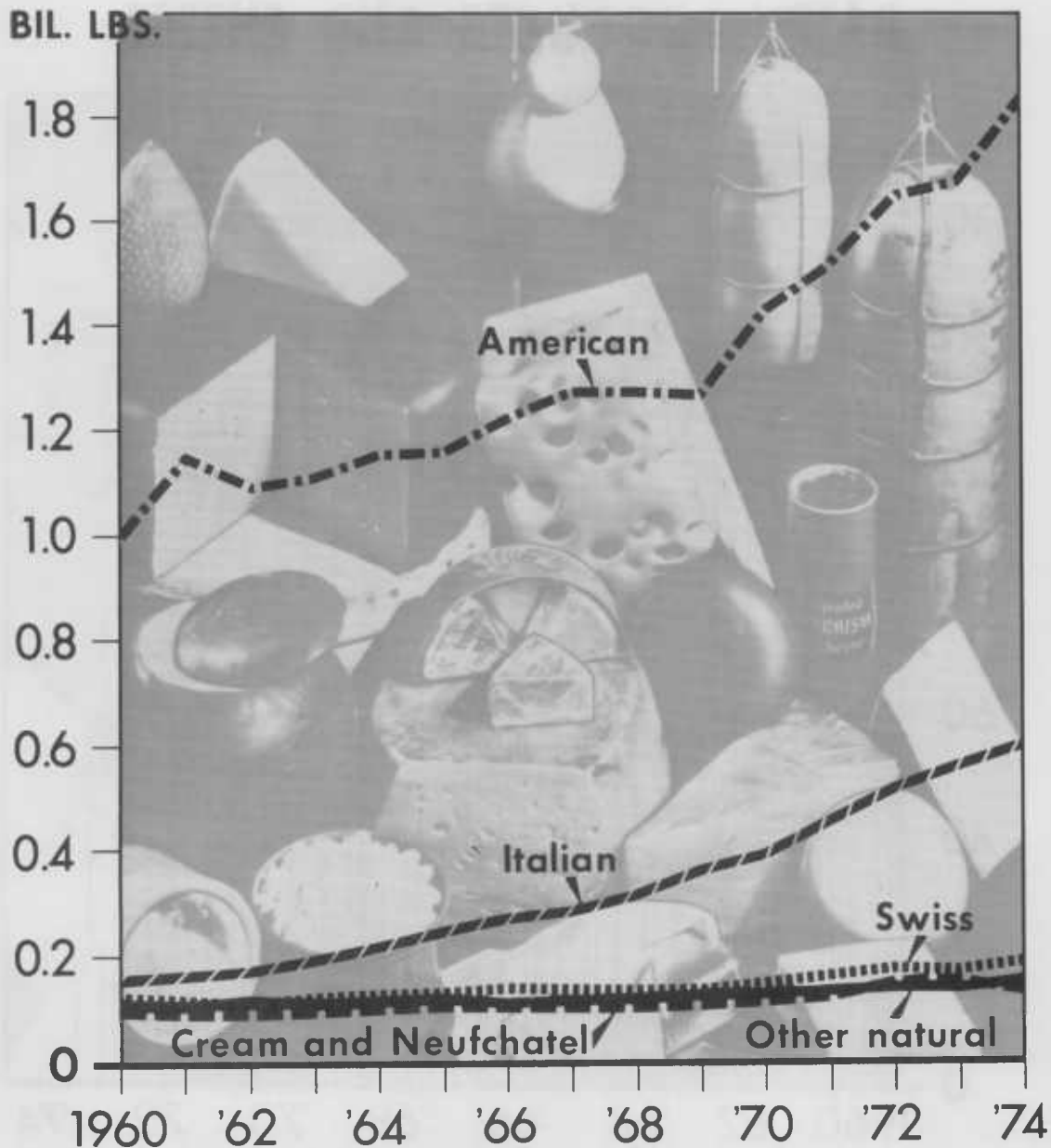
UTILIZATION OF MILK SUPPLY FOR ALL MANUFACTURED DAIRY PRODUCTS AND CHEESE



SOURCE: APP. A.

Figure 1

PRODUCTION OF SELECTED NATURAL CHEESES



SOURCE: APP. A.

Figure 2

PRODUCTION OF PROCESS CHEESE PRODUCTS

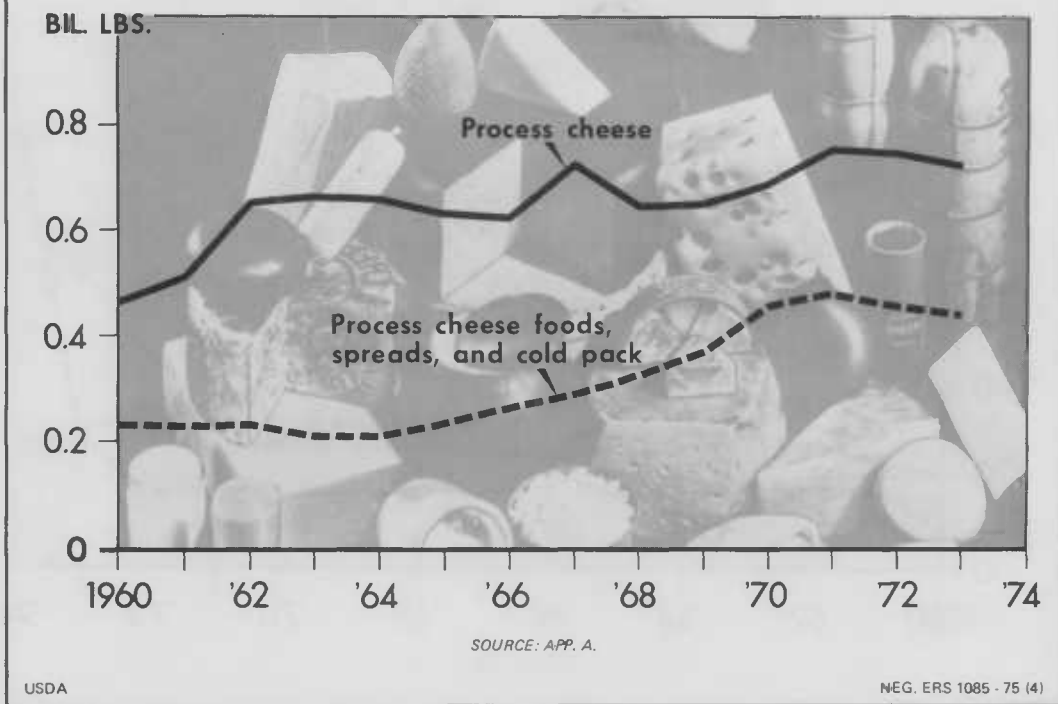


Figure 3

However, the proportion of natural cheese used in process cheese products has declined in recent years.

Compared with natural cheese, seasonal variations in the production of process cheese products are relatively small. However, production is slightly higher in the fall and often lower in summer than in winter.

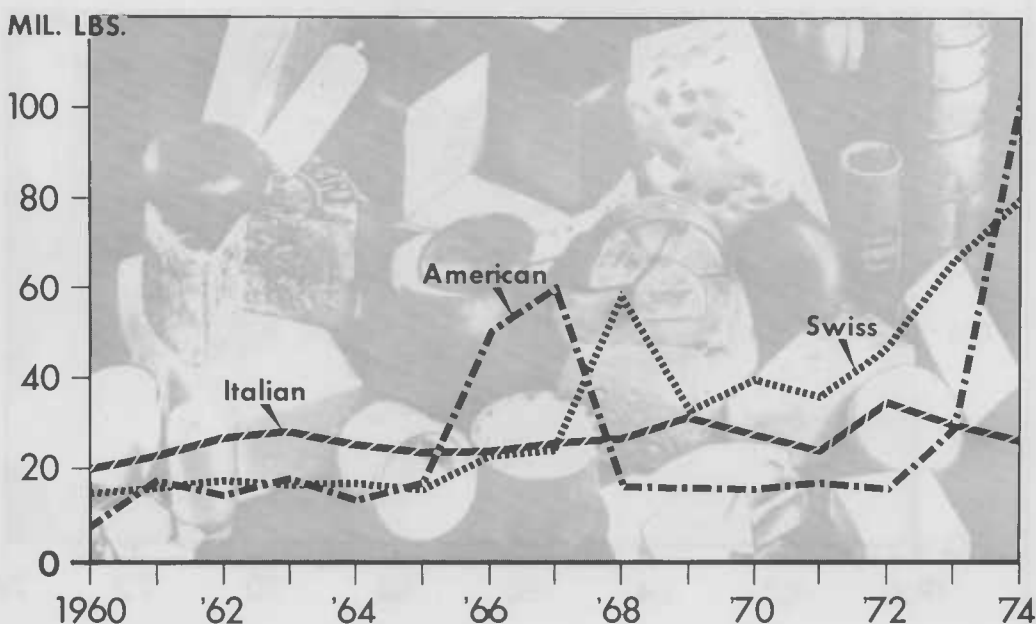
Imports

A high proportion of total imports, 68 percent in 1973, is subject to quotas (discussed later). Total imports of cheese, although showing large fluctuations from time to time, increased overall since 1960 (fig. 4). In 1974, imports of cheese totaled a record 316 million pounds, equal to 10.9 percent of domestic production.

Imports of American-type cheese were equal to 6.1 percent of domestic American natural production and imports of Italian-type cheese, to 4.4 percent of domestic Italian production, in 1974. Imports of Swiss cheese were 43.5 percent of domestic Swiss production.

Recently, imports of American-type and Swiss cheeses have been highest in winter and lowest in the summer. Imports of Italian-type cheeses have been greatest in the spring and winter.

SELECTED CHEESE IMPORTS



SOURCE: APP. A.

USDA

NEG. ERS 1086 · 75 (4)

Figure 4

Commercial Stocks

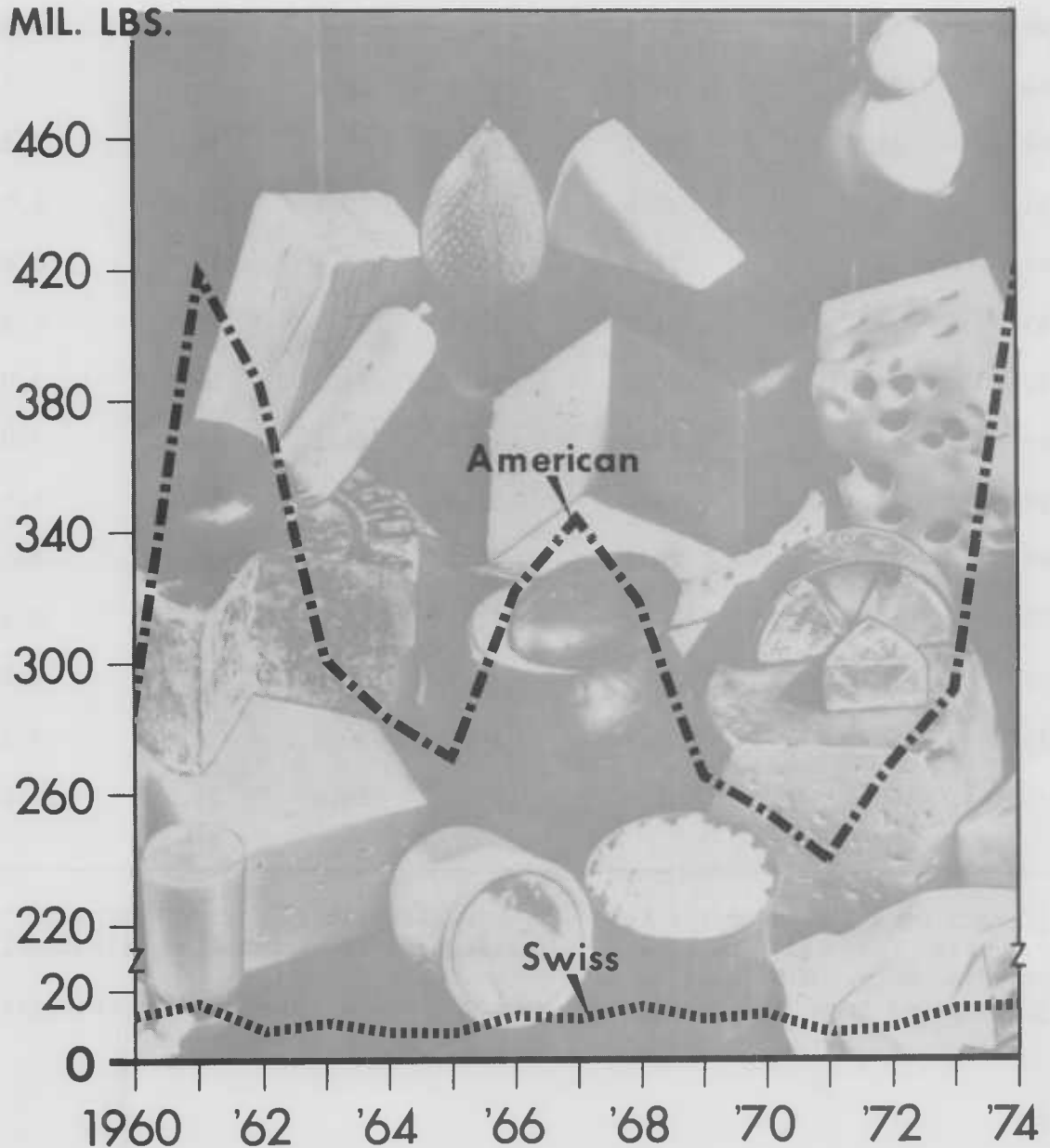
Year-end stocks of all cheese ranged from 304 to 494 million pounds during 1960-74 (tables A.15-A.18 and fig. 5), and averaged 356 million pounds. Although the quantity of total cheese stocks showed no trend during this period, stocks generally declined as a proportion of total annual production since 1960. Year-end stocks were as high as 29 percent of production during 1961 and as low as 13 percent during 1971-73. This trend was reversed in 1974 with ending stocks increased to 17 percent of production.

Over the past few years, stocks have been highest in the summer and early fall, following the peak spring production season. They have usually been reduced during the winter months.

Price Spreads

The retail price of an 8-ounce package of process American cheese increased about 80 percent from 1960 to 1973 (table 1). During this period the farm value doubled and the farm-retail price spread increased from 19.0 to 30.6 cents. The farm-retail price spread as a proportion of the retail value ranged from 55.6 to 59.1 percent from 1960 through 1972. It then declined to 50.7 percent in 1973 due to record milk prices and the effect of economic controls. This spread includes the costs of assembling milk, manufacturing process cheese into the final product, packaging, and distribution.

COMMERCIAL STOCKS OF SELECTED NATURAL CHEESES



SOURCE: APP. A.

USDA

NEG. ERS 1087 - 75 (4)

Figure 5

Table 1--Farm-retail price spreads of American process cheese, 1960-73

Year	Price per 8-ounce package		Farm value 1/	Farm-retail spread		
	Retail 1/	Wholesale 2/		Total	Wholesale-retail	Farm-wholesale
	<u>Cents</u>					
1960	33.9	19.8	14.9	19.0	14.1	4.9
1961	35.9	19.8	15.1	20.8	16.1	4.7
1962	35.7	19.2	14.5	21.2	16.5	4.7
1963	35.7	20.8	14.8	20.9	14.9	6.0
1964	36.6	21.1	15.1	21.5	15.5	6.0
1965	37.4	21.7	15.3	22.1	15.7	6.4
1966	41.9	25.6	18.6	23.3	16.3	7.0
1967	43.6	25.4	18.4	25.2	18.2	7.0
1968	44.4	26.2	19.3	25.1	18.2	6.9
1969	47.0	28.7	20.7	26.3	18.3	8.0
1970	50.4	30.7	22.2	28.2	19.7	8.5
1971	52.8	31.8	22.9	29.9	21.0	8.9
1972	54.3	33.4	24.1	30.2	20.9	9.3
1973	60.4	39.9	29.8	30.6	20.5	10.1

1/ Farm-retail spreads for food products, Econ. Res. Serv., U.S. Dept. Agr., Misc. Pub. 741, Jan. 1972. Marketing and Transportation Situation, Econ. Res. Serv., U.S. Dept. Agr.

2/ Computed from USDA Market News quotation on 5-pound loaf at Chicago.

REGULATION

Federal Price Support

Price support operations have been carried out for specified commodities since 1933. The Agricultural Act of 1949, as amended, directs the Secretary of Agriculture to support the price of manufacturing milk through purchases of dairy products. To accomplish this, the Department of Agriculture purchases at announced prices all that is offered of natural Cheddar cheese as well as butter and nonfat dry milk which meet USDA grade and packaging specifications. The Department also buys process cheese on a competitive bid basis at prices equal to the announced purchased price for natural cheese plus the additional costs of packaging and processing.

The Secretary announces the support price for manufacturing milk for each milk marketing year on or before April 1. (This price may be raised, but not lowered, during the year.) At the same time, the announcement is made of the prices USDA's Commodity Credit Corporation (CCC) will pay for natural cheese, butter, and nonfat dry milk.

USDA purchase prices are set at levels expected to support the annual average price which plants pay to farmers for manufacturing milk equal to the announced support price. In determining these purchase prices, consideration is given to developments in average processing and marketing margins, relative market prices, production, stocks, consumption of different dairy products, results of recent price support operations, relative volume of purchases, CCC stocks, and utilization in available program outlets (14, p. 17).

The above considerations are used to estimate returns to cheese plants, as well as to butter-powder plants (plants that manufacture butter from milkfat and powdered milk from the remaining skim milk), which will accomplish support price objectives. The CCC purchase price for Cheddar cheese is then calculated, using the average manufacturing and marketing margin, to result in this return to plants. 3/

In addition to cheese purchases under the price support program, the Secretary may purchase cheese at market prices. Under Section 709 of the Food and Agricultural Act of 1965, CCC funds may be used to purchase sufficient supplies of cheese to meet the requirements of any domestic programs where there are insufficient stocks available for such program uses. Purchases of dairy products at market prices may also be made under Section 4a of the Agriculture and Consumer Protection Act of 1973, as amended.

Generally, purchases have varied inversely with the degree to which market prices exceed support prices. They have been a small proportion of total annual production of Cheddar cheese, taking just over 2 percent of production in the highest years. The CCC purchases under price support and Section 709 are shown in table A.16 for 1960-73.

3/ The calculation of CCC purchase prices for support of manufacturing milk at \$7.24 per hundredweight which was announced on January 3, 1975, and effective through March 31, 1976:

Target returns to cheese plants per cwt.	\$7.24
Spread between price of manufacturing milk and the market value of cheese and whey fat per 100 pounds of milk	\$0.87
Market value of cheese and whey fat per 100 pounds of milk	8.11
Value of 0.25 pound of whey fat	.17
Value of other whey solids	.15
Value of cheese:	
Per 100 pounds of milk	7.79
Per pound-rounded (using a yield of 10.1 pounds)	.7725

Although either natural Cheddar or pasteurized process American cheese may be purchased, most purchases in recent years have been pasteurized process American cheese in 5-pound or 2-pound loaves, although there have been some current purchases of natural Cheddar cheese in 40-pound blocks. The process cheese is purchased for later delivery and may not be manufactured at time of purchase.

If necessary, cheese is stored in commercial warehouses which are inspected, approved, and under storage agreements with CCC. Process cheese usually moves immediately to program outlets.

Import Restrictions

Import controls are authorized under Section 22 of the Agricultural Adjustment Act of 1933, as amended. Section 22 directs the Secretary of Agriculture to advise the President whenever he believes any products are being imported which will:

- (a) Render or tend to render ineffective or materially interfere with any price support program or other programs relating to agricultural commodities undertaken by the Department of Agriculture, or
- (b) Reduce substantially the amount of any product processed in the United States from any agricultural commodity or product included in any such program or operation.

Imports of certain specified types of cheeses have been subject to import quotas since mid-1953. Current cheese quotas are listed in table A.17.

Normally, the International Trade Commission will conduct an investigation (including a public hearing) at Presidential request on any proposed change and submit findings and recommendations to the President for decision. Many such reports have been made in recent years (20,21,23,24).

When a condition requires emergency treatment, the President is empowered to take action prior to the required investigation and report from the Commission. This was done in January 1974, when the President by proclamation temporarily increased Cheddar cheese quotas by 100 million pounds for a 3-month period ending March 31, 1974. This increase was administered by the Bureau of Customs, U.S. Department of Treasury, on a first-come, first-served basis and import licenses were not required. The quota was 99-percent filled. The subsequent International Trade Commission report to the President supported this action by its decision that the additional quantity would not interfere with the Department's price support program for milk (22).

Import controls on almost all cheeses under regular quotas are administered by the Import Branch, Foreign Agricultural Service, U.S. Department of Agriculture, through the issuance of import licenses. These licenses are issued to enable imports by type of cheese and country of origin. During the first 6 months of any quota year no more than one-half of the annual quota may be allocated. Thus, the quotas are allocated under licenses issued on January 1 and July 1 of each quota year. The unused portion of a licensed share cannot be carried forward to the next year.

Quotas on Canadian natural Cheddar cheese made from unpasteurized milk and aged not less than 9 months are administered by the Bureau of Customs on a first-come, first-served basis. One-half of the 1.2-million-pound quota is open on January 1, and the balance on July 1. The quota is usually filled shortly after each opening date.

Quality Regulation

Milk

All surplus Grade A milk which is made into cheese has relatively uniform standards of farm inspection for sanitation. These standards set by State and local authorities are based on the 'Grade A Pasteurized Milk Ordinance--1965 Recommendations of the U.S. Public Health Service."

Requirements for inspection of farms with manufacturing grade milk vary widely among States. As of late 1974, all but six States required farm inspection. At that time, all but six States also had plant inspection requirements specifically for dairy manufacturing plants. All States have basic food laws covering food items in intra-state commerce.

A USDA-recommended standard for State adoption covering both farm and plant inspection was created in 1963 and revised in 1972 (3). When adopted by the States, these recommended requirements covering farm facilities, milk quarters, and processing plants would give uniformity to sanitation standards for manufacturing-grade milk. Most States have laws and regulations that are in accordance in part or totally with the USDA recommendations.

Quality control of manufacturing grade milk is largely done at the procurement stage by the cheese manufacturing firms. If there are milk quality problems a plant fieldman consults with the producer. For cheese manufactured in plants surveyed under the USDA voluntary plant inspection service there are requirements for milk quality including checks on plant records for bacteria and sediment tests on producer's milk, and USDA testing for the bacteria count of mixed milk in plant storage tanks (16).

Domestic Cheese

All food products, including cheese, moving in interstate commerce are subject to requirements of the Food, Drug, and Cosmetic Act, which is administered by the Food and Drug Administration (FDA), U.S. Department of Health, Education, and Welfare.

USDA offers an inspection service which is required of all cheese plants (and butter and dry milk plants) selling to the CCC under the dairy price support program, and available to plants requesting grading for commercial transactions. Under this program cheese plants are inspected at least twice yearly for milk quality, sanitary practices, condition of the plant and equipment, and processing procedures. A fee is charged to cover the cost of inspection. This program has received wide industry participation not only because it is required of plants seeking to qualify for Government sales, but also because it is a valuable aid in improving product quality, marketing, and internal management. In 1973, 55 percent of all cheese plants, including almost all large plants, used this inspection service.

The FDA provides regulations concerning the pasteurization of milk and the curing, labeling, and composition of cheese entering interstate commerce. Cheese produced and marketed within a State is regulated under State standards. In general, State compositional standards closely follow Federal standards (15).

Imported Cheese

Imported cheese must meet the same standards as domestically produced cheese. The FDA is charged with inspection under the Food, Drug, and Cosmetic Act. The Bureau of Customs notifies FDA of shipments and FDA then either clears or inspects for clearance.

MANUFACTURE OF NATURAL CHEESE

Natural cheese is generally manufactured by plants located in rural communities near the source of milk supplies. In the past, numerous plants in the major cheese-producing areas often received milk hauled in every day by producers. The plants were usually small family-owned or local cooperative businesses.

Recent changes in economics, institutions, technology, and transportation have resulted in larger, more widely spaced plants. Some are highly efficient, capable of running 24 hours a day, 7 days a week. They obtain milk supplies from producers over a broad area and may be supplied in part by nearby smaller plants which act as receiving stations and send their milk to the central plant.

Much of the information in both this section of the report and in a later section on intermediate distribution is derived from a national survey of cheese plants conducted in April 1974. The survey procedure is described in appendix B and a copy of the survey questionnaire is included in appendix C. The results are generally reported for three regions and the total United States. In 1973, Region 1 (Wisconsin) produced 40 percent of U.S. cheese, Region 2 (West North Central--Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota) produced 28 percent, and Region 3 (all other States) produced 32 percent. Regions reported in tables 3 and 4 are standard Statistical Reporting Service regions.

Number and Size of Plants

The number of plants manufacturing natural cheese is declining and average plant production is increasing (table 2). The exception is for Italian-type cheese, which had more plants in 1973 than in 1950. Many cheese plants manufacture more than one type of cheese, so the average production of all plants in table 2 is greater than the average plant production of any one cheese type.

In 1973 there were 865 cheese plants, down from 2,159 plants in 1950. Average production per plant was 3.1 million pounds in 1973 compared with 552,000 pounds in 1950. The North Atlantic and the North Central regions had the greatest number of plants in 1972 (table 3). The proportion of plants producing less than 1 million pounds annually was 66 percent in the North Atlantic, 36 percent in the North Central, 23 percent in the South, and 55 percent in the West.

Recent years have shown a pattern of decreasing numbers of smaller plants and increasing numbers of larger plants (table 4). Cheese plants manufacturing 2 million or more pounds annually represented 9 percent of all plants in 1957, 14 percent in 1963, and 37 percent in 1972. The exception to the general decline in smaller plants is Italian-type cheese, which has shown increases in the number of plants manufacturing 50,000 pounds or less annually as well as in the plants making over 2 million pounds annually.

Although large plants represent a small proportion of total plant numbers, they account for a sizable proportion of production (table 5). The total 1973 output of American-type cheese could have been produced by only 53 plants in the largest production size category, instead of by the actual 592 plants. Similarly, the number of Italian-type cheese plants could have been cut from 189 to 20 and the number of Swiss cheese plants, from 75 to 16. These comparisons assume the plants would be geographically located to minimize milk procurement costs, which is not presently possible since milk production concentration varies considerably by State.

The survey results indicate there were an average of 20 employees per cheese manufacturing plant in 1973 (table 6). On this basis the total number of such em-

Table 2--Number and average production of natural cheese manufacturing plants, selected years, 1950-73

Year	Cheese type or variety						Total	
	American		Italian		Swiss			
	Plants	Average plant production	Plants	Average plant production	Plants	Average plant production		
	<u>Number</u>	<u>1,000 pounds</u>	<u>Number</u>	<u>1,000 pounds</u>	<u>Number</u>	<u>1,000 pounds</u>	<u>Number</u>	<u>1,000 pounds</u>
1950	1,621	551	167	370	284	350	2,159	552
1955	1,358	740	158	544	228	512	1,789	764
1960	1,008	988	193	816	164	738	1,419	1,042
1965	864	1,341	182	1,343	123	998	1,209	1,452
1970	669	2,128	197	1,998	90	1,600	963	2,286
1973	592	2,825	189	2,991	75	2,190	865	3,104

Source: (18)

Table 4--Number of plants making cheese, by production size group and region, 1957, 1963, and 1972

Output per plant (1,000 lbs.)	North Atlantic			North Central			South			West			United States		
	1957	1963	1972	1957	1963	1972	1957	1963	1972	1957	1963	1972	1957	1963	1972
	<u>Number</u>														
Less than 50	36	30	25	46	31	11	4	9	6	19	11	11	105	81	53
50-99	18	12	8	33	13	5	--	3	1	7	4	3	58	32	17
100-249	31	27	24	195	86	14	6	5	2	20	9	6	252	127	46
250-499	20	22	16	341	200	67	5	3	--	19	18	12	385	243	95
500-749	12	7	8	238	180	66	6	2	--	16	14	4	272	203	78
750-999	7	7	7	131	122	70	9	10	3	7	4	6	154	142	86
1,000-1,499	10	12	10	133	128	97	8	7	3	14	14	10	165	162	120
1,500-1,999	9	5	4	46	91	66	11	10	--	2	7	3	68	113	73
2,000 or more	13	23	31	88	116	244	33	28	37	10	12	21	144	179	333
2,000-2,999	N.A.	N.A.	6	N.A.	N.A.	91	N.A.	N.A.	13	N.A.	N.A.	4	N.A.	N.A.	114
3,000-4,999	N.A.	N.A.	12	N.A.	N.A.	66	N.A.	N.A.	12	N.A.	N.A.	6	N.A.	N.A.	96
5,000-9,999	N.A.	N.A.	7	N.A.	N.A.	47	N.A.	N.A.	11	N.A.	N.A.	5	N.A.	N.A.	70
10,000-19,999	N.A.	N.A.	4	N.A.	N.A.	25	N.A.	N.A.	1	N.A.	N.A.	6	N.A.	N.A.	36
20,000 or more	N.A.	N.A.	2	N.A.	N.A.	15	N.A.	N.A.	--	N.A.	N.A.	--	N.A.	N.A.	17
Total plants:	156	145	133	1,251	967	640	82	76	52	144	94	76	1,603	1,282	901

N.A. = Not available. -- = 0.

Source: Plants Manufacturing Dairy Products by Production-Size Groups and Geographic Distribution, 1957, Agr. Mktg. Serv., U.S. Dept. Agr., AMS-301, Mar. 1959; Plants Manufacturing Dairy Products by Production-Size Groups and Geographic Distribution, 1963, Statis. Rptg. Serv., U.S. Dept. Agr., SRS-5, Mar. 1965; and Plants Manufacturing Dairy Products by Production-Size Groups and Major Regions, United States, 1972, Statis. Rptg. Serv., U.S. Dept. Agr., Dairy Products, Feb. 1974.

employees in the United States in 1973 was 17,300. American-type cheese plants averaged only 16 employees for all plant sizes, equivalent to 9,472 employees for all American plants in 1973.

Production Areas

Wisconsin is the leading State in the production of each of the major cheese types and varieties with the exception of Swiss. Its share of total natural cheese production declined slightly in recent years from 43.1 percent in 1970 to 39.9 percent in 1973.

American-Type Cheese

Production of American-type cheese is heavily concentrated in the north central area of the United States near large milk supplies (table 7). Region 1 produced 43

Table 5--Number and production of large cheese plants, 1972

Cheese type	Size group (annual production)	Plants		Production	
		Number	Percent	1,000 pounds	Percent
American	20,000+	11	1.8	345,572	21.0
Italian	20,000+	3	1.5	83,975	16.4
Swiss	10,000+	6	7.9	60,000	33.8
Total	20,000+	17	1.9	564,498	21.7

Source: Dairy Situation, Econ. Res. Serv., U.S. Dept. Agr., July 1974.

Table 6--Average number of employees per plant, 1973

Region <u>1/</u>	Plant size <u>2/</u>			
	Small	Medium	Large	All sizes
	<u>Number</u>			
1	5	30	102	15
2	12	27	93	32
3	11	35	77	22
Total U.S.	8	31	90	20

1/ Region 1: Wisconsin; Region 2: Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota; Region 3: All other States.

2/ Small: Less than 2 million pounds annually; Medium: 2-9.9 million pounds annually; Large: 10 million pounds or more annually.

percent of American-type cheese in 1973. Region 2 produced 34 percent. Twenty States accounted for 97 percent of American-type cheese production in 1973.

Although Wisconsin is by far the largest producer of American-type cheese, it ranked 15th in average plant production in 1973, well below the U.S. average. In contrast, all States in the West North Central region ranked above the national average in plant production. Wisconsin had 315 plants producing American-type cheese, while Minnesota with only 18 plants produced a third as much as Wisconsin.

Until recently, cheese production was concentrated relatively more in Wisconsin than in other areas while butter-powder (nonfat dry milk) production was concentrated relatively more in Minnesota. Although Wisconsin has many new production facilities, it retains numerous older plants.

Minnesota has entered the cheese industry more strongly in recent years. It has a greater proportion of large plants than Wisconsin and uses newer technology for several reasons. First, Minnesota is one of the centers of the cooperative merger and consolidation movement. Second, butter plants had already consolidated to some degree in Minnesota. Therefore, when the demand for cheese increased, it was relatively easier to build large cheese plants because of established procurement and transportation systems. Finally, there has been an increased demand for fluid milk in the traditional cheese-producing area of Wisconsin. Fluid milk has first call on milk

Table 7--Leading States producing American-type cheese, 1973

State	Total production	Average plant production ^{1/}
	<u>1,000 pounds</u>	
Wisconsin	720,104	2,686 (15)
Minnesota	24,560	13,646 (1)
Iowa	97,487	4,874 (2)
Missouri	71,834	3,991 (3)
New York	61,212	3,826 (5)
Idaho	50,794	3,175 (9)
North Dakota	50,794	3,132 (10)
Kentucky	47,216	3,935 (4)
South Dakota	45,298	2,831 (12)
Utah	36,592	2,614 (13)
Kansas	32,619	3,262 (8)
Nebraska	31,212	3,121 (11)
Tennessee	25,302	2,109 (17)
Oregon	20,844	3,474 (6)
Illinois	17,145	1,072 (20)
Indiana	16,840	3,368 (7)
Ohio	16,823	2,403 (14)
Michigan	14,538	1,454 (18)
Vermont	13,032	2,172 (16)
Washington	8,626	1,232 (19)
20 State total	1,623,253	
U.S. total	1,672,515	2,825

^{1/} Rank in average plant production given in parentheses.

Source: (18).

supplies because it returns a higher price. Further expansion of fluid markets in and near Wisconsin is likely to reduce the proportion of cheese produced in that State in the future. Present trends indicate Minnesota, Iowa, the Dakotas, and Nebraska will supply an increasing proportion of expanding cheese demands.

Since American-type cheese production is so heavily concentrated in several areas, a large proportion is shipped out for consumption. For example, an estimated 95 percent of the cheese produced in Wisconsin is exported outside the State.

Utah and Idaho together accounted for over 5 percent of the U.S. production of American-type cheese in 1973. This area has a large supply of milk with a limited fluid market. A sizable cheese manufacturing industry has developed there largely for shipment to the west coast, which produces little American-type cheese. Substantial amounts of cheese also flow from the North Central Region to Utah and Idaho where it is further processed for the west coast market.

New York was fifth in the production of American-type cheese and fifth in average plant production in 1973. However, cheese manufacturing in New York differs from that in many other regions. Production is partially from surplus Grade A milk and although butter-powder production is the primary balance for fluid milk in New York, cheese production is also subject to a variable supply of milk both seasonally and within the week. Some plants, even large ones, shut down entirely during winter when milk production is short. In contrast to the North Central Region, only small amounts of American-type cheese are produced in New York for further processing. Instead it is generally aged for retail sale as natural cheese, usually in the East, South, and Midwest.

Kentucky, which ranked eighth in production and fourth in average plant production, benefited from high cheese prices in 1973 and received a large amount of surplus Grade A milk for cheese manufacturing. In addition, there is a large amount of manufacturing-grade milk in Kentucky and Tennessee, much of which goes into cheese production. Most is bulk cheese, packed in barrels and used for further processing.

Other States, such as Oregon and Vermont, have established themselves in the retail market as makers of quality American-type cheeses. However, they make only a small proportion of total U.S. production.

Italian-Type Cheese

Ten States produced 79 percent of the Italian-type cheese in the United States in 1973 (table 8). The leading State in production was Wisconsin, while the leading State in average plant production was Minnesota. Other important production areas are in the Northeast and California. The Northeastern States have a long tradition of production, while California has recently become a major producer, primarily of Mozzarella cheese.

Italian-type cheese production has been concentrated in the North Central Region and New York since Italian cheesemakers originally settled in those areas. Those areas best duplicated the climate of the Old World production areas, which was important in the production and storage of cheese.

Small Mozzarella plants account for practically all of the cheese production in the Northeast. The Mozzarella produced in this area has a higher moisture content and is thus more perishable than the Mozzarella produced in Wisconsin. The higher-moisture Mozzarella is primarily used in the home, whereas most of the low-moisture Mozzarella made in Wisconsin is utilized by the institutional trade.

Table 8--Leading States producing Italian-type cheese, 1973

State	Production	Average plant production 1/
	<u>1,000 pounds</u>	
Wisconsin	199,674	3,503 (5)
New York	81,430	2,908 (7)
California	35,584	3,558 (4)
Nebraska	34,850	6,970 (2)
Minnesota	21,297	7,099 (1)
Vermont	19,773	3,296 (6)
Illinois	18,072	1,807 (8)
Washington	14,315	3,579 (3)
New Jersey	12,361	1,124 (9)
Pennsylvania	10,502	808 (10)
10 State total	447,858	
U.S. total	565,270	2,991

1/ Rank in average plant production given in parantheses.

Source: (18).

Swiss Cheese

Swiss cheese production is much more concentrated geographically than either American or Italian-type production. In 1973, four States produced over two-thirds of the U.S. Swiss cheese. Illinois had the highest production (29 percent of the U.S. total) and a high average plant production due to its few large plants. Wisconsin was second in Swiss production with 22 percent of the total. Many of the plants are small and located in the traditional Swiss cheese producing area of southwest Wisconsin, while a few large plants are located in other areas. Other States with significant amounts of Swiss production were Utah, Ohio, and Pennsylvania.

Milk Supply

Milk used for the manufacture of cheese generally moves a short distance to the plant, in contrast to milk used for fluid purposes which may go hundreds of miles. In the past local milk routes were the transferrable property of individual haulers. However, with the transition of most routes to bulk pickup, there has been a movement away from the individual owning one route toward the manufacturing firm supplied by one organization. The trend has been toward either an independent hauler serving the entire cheese business or the business itself providing all assembly services.

Producers are generally "price takers" as opposed to "price setters", with manufacturing plants setting the milk price based on their returns. Smaller manufacturers primarily consider the prices paid by competing buyers.

Although plants compete vigorously for raw milk, price competition is generally deemphasized. Rather, competition is through the assembly functions. Examples of competitive practices used occasionally are subsidized hauling, patronage refunds, premiums based on fat solids or a combination of fat solids and nonfat solids, farm supplies sold at a reduced cost, money advanced against future milk checks, group insurance plans, fieldman service for physical improvements such as bulk tanks, market information, and integrity (prompt payment of the milk check over time). The manu-

facturer offers these advantages in assembly services to help earn the goodwill of producers and assure a steady supply of milk to the plant.

Sources of Milk

Producers are the main source of milk for the manufacture of cheese (table 9). In 1973, bulk producers supplied 57.5 percent, can producers 8.2 percent, producer cooperatives 18.2 percent, and other plants and receiving stations 16.1 percent. Larger plants got less of their total supply directly from producers and more from cooperatives and other plants and receiving stations. Producer milk in cans was a very small part of total milk supply for the large plants.

The manufacturers of American-type cheese obtained relatively more milk directly from producers than did the manufacturers of all cheese (table 9). Can producers supplied 10 percent of the milk to American-type cheese manufacturers.

Table 9--Average sources of milk used in cheese production, 1973

Source	Plant size ^{1/}						All sizes	
	Small		Medium		Large		American: All	American: All
	: American: All	: American: All	: American: All	: American: All	: American: All	: American: All	: American: All	: American: All
	: cheese	: cheese	: cheese	: cheese	: cheese	: cheese	: cheese	: cheese
	<u>Percent</u>							
Individual producers, bulk	70.2	61.9	70.9	60.4	58.3	53.1	66.2	57.5
Individual producers, can	20.0	18.6	10.2	9.2	4.4	3.1	10.1	8.2
Directly from producer cooperatives	4.5	8.9	9.7	16.5	16.2	23.6	11.0	18.2
Other plants or receiving stations	5.3	10.6	9.2	13.9	21.1	20.2	12.7	16.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

^{1/} See footnote 2, table 6.

Producer Description

Of the 225 survey plants, 196 reported receiving part of their milk directly from producers. The survey measured the number of producers per plant and the distance of these producers from the cheese plants. Although the number of producers was reported for both June and November 1973, it remained quite stable, so an average of these 2 months is reported.

These cheese manufacturers were supplied by an average of 134 producers per plant in 1973 (table 10) for a total of 116,000 producers shipping directly to cheese plants. Although larger plants tended to receive a smaller portion of their milk directly from producers, the average number of producers supplying these larger plants was still much greater than the number supplying smaller plants. Region 2 averaged the highest number of producers per plant.

Table 10--Average number and distance of producers supplying all cheese plants, 1973

Region <u>1/</u>	Plant size <u>2/</u>									All sizes		
	Small			Medium			Large					
	Producers	Distance from plant		Producers	Distance from plant		Producers	Distance from plant		Producers	Distance from plant	
		Average	Farthest		Average	Farthest		Average	Farthest		Average	Farthest
	<u>No.</u>	<u>Miles</u>	<u>Miles</u>	<u>No.</u>	<u>Miles</u>	<u>Miles</u>	<u>No.</u>	<u>Miles</u>	<u>Miles</u>	<u>No.</u>	<u>Miles</u>	<u>Miles</u>
1	42	6	15	164	13	33	654	25	54	96	9	21
2	71	28	79	191	30	69	579	33	90	212	30	75
3	100	26	56	237	44	100	324	44	106	153	32	72
Average												
U.S.	67	16	36	197	28	66	509	35	86	134	21	48

1/ See footnote 1, table 6.

2/ See footnote 2, table 6.

The producers were relatively closer to the plants in Region 1, reflecting the high density of both dairy farms and plants (table 10). Since producers in other areas were located two to three times farther from the plant, Region 1 would seemingly realize a considerable advantage in assembly costs and operations.

Larger plants must pull milk from a larger area, offsetting some of the economies of scale. However, large Wisconsin plants pulled from an area which was comparable to procurement areas of smaller plants in the other regions.

Grade of Milk

Cheese is manufactured from either surplus Grade A or manufacturing-grade milk. There has been a continuing decline in the proportion of milk which is of manufacturing grade, to 23 percent in 1973. However, in the principal cheese-producing areas in 1973 the proportion of total milk production of manufacturing grade was still large, 41 percent in Wisconsin (Region 1) and 55 percent in the West North Central Region (Region 2).

About 35 percent of the milk used to manufacture cheese in the United States in 1973 was surplus Grade A. Thus, about 11 percent of the total Grade A milk was used to manufacture cheese. Larger cheese plants used relatively higher proportions of Grade A milk (table 11). Plants in Region 3 (all other States) manufactured about 50 percent of their cheese from surplus Grade A milk. This reflects the large proportion of fluid grade milk and the small amounts of manufacturing grade milk in parts of the region. Cheese tends to be used as an outlet for reserve supplies of fluid markets, although not necessarily the major outlet, more in parts of this area than in Regions 1 and 2. There are some problems in starting and stopping production using cheese rather than butter as a balancing operation when milk supplies are limited.

Milk Standardization

A high butterfat level, along with a high level of nonfat solids, in milk used in the manufacture of cheese results in greater cheese yields. The level of butterfat in milk may be adjusted by skimming off some of the butterfat from the milk (standardizing), and selling or using that butterfat for the manufacture of butter, or by the less common method of adding nonfat solids to the milk.

Table 11--Proportion of all cheese manufactured from Grade A milk, 1973

Region <u>1</u> /	Plant size <u>2</u> /		
	Small	Medium	Large
	<u>Percent</u>		
1	3	22	54
2	6	19	27
3	54	44	58
Total U.S.	24	29	46

1/ See footnote 1, table 6.

2/ See footnote 2, table 6.

The rate of standardization used often depends on the butterfat price and the minimum butterfat content required for a particular cheese variety. If the price of butterfat is relatively low it returns relatively more money if used in cheese, so manufacturers would choose a higher level of standardization or no standardization. With a relatively high price, butterfat would earn relatively more money in butter, so a relatively lower standardization level would be used. Thus, plants may vary the level of standardization even seasonally.

Factors other than price considerations also affect the level of standardization. The cheese buyer may not want any more than the legal minimum fat content in the cheese. Also, many cheese plants are too small to economically standardize their milk at any level because of a small volume or lack of a market for the butterfat.

Some level of standardization was reported for 16 percent of the small plants, 53 percent of the medium-sized plants, and 43 percent of the large plants. Those plants which reported standardizing American-type cheese standardized at an average of 3.5 percent, with no differences among plant sizes. In comparison, the U.S. average butterfat content of milk received for the manufacture of American-type cheese was 3.78 percent in January 1973 and 3.56 percent in June 1973.

Milk Storage Capacity

As bulk handling of milk has decreased the need for receiving stations, it has also increased the need for bulk storage at the manufacturing plant. Other pressures for increased milk storage come from the increasing variability of fluid use during the week and an increasing reluctance of employees to work Sundays and night shifts. Thus, storage capacity is often needed to hold milk on days when cheese is not manufactured.

Milk storage capacity in cheese plants averaged 20,000 gallons per plant in 1973 (table 12). This includes milk storage capacity for all manufactured dairy

Table 12--Average milk storage capacity at all cheese plants, 1973

Region <u>1</u> /	Plant size <u>2</u> /			
	Small	Medium	Large	All sizes
	<u>1,000 gallons</u>			
1	9	29	115	18
2	13	29	116	37
3	9	28	57	17
Total U.S.	9	29	95	20

1/ See footnote 1, table 6.

2/ See footnote 2, table 6.

products. The milk storage capacity contains enough volume for approximately 2.8 days of cheese manufacturing for small plants, 1.5 days for medium-sized plants, and 2.0 days for large plants. This assumes 365 manufacturing days a year for the small, medium, and large plant size groups of 1 million, 6 million, and 15 million pounds annual cheese production, respectively.

Plant Organization

The plant survey reported 53 percent of the manufacturing plants were proprietary corporations in 1973 (table 13). These plants manufactured 59 percent of the total cheese produced. Over 22 percent of the plants were cooperatives and they produced about one-third of the cheese. The remainder of the plants, about 25 percent, were privately owned and produced only about 8 percent of production.

Dairy cooperatives have been involved in many of the changes in plant organization in recent years. From 1967 to 1970 cooperatives underwent an intensive merger movement and a few large regional cooperatives were formed in the central United States (8). The mergers were an attempt to obtain greater market stability, improved bargaining position, and increased operational efficiency for both fluid and manufacturing operations. Problems involved overlapping producer procurement areas and excess or inefficient plant capacity. The manufactured product facilities are aids developed to assist in cooperative bargaining and maximizing Class I use. The regional cooperatives in the Midwest evolved as full-service organizations to take advantage of the market opportunities for manufactured as well as fluid products.

An intensive consolidation of manufacturing facilities, including cheese plants, followed the merger activity. Many smaller plants were closed and the remaining plants increased their volume. Consolidation ensured a continuous supply of milk to the larger plants with a few smaller plants for balancing milk supplies for the fluid market. This enabled service to the fluid market with minimum disruption of cheese manufacturing.

Table 13--Number of plants manufacturing natural cheese and production, by type of firm, 1973

Type of firm	Plants		Production	
	<u>Number</u>	<u>Percent</u>	<u>1,000 pounds</u>	<u>Percent</u>
Corporations:				
Multiunit	137	15.8	695,506	25.9
Single unit	322	37.2	888,851	35.1
Cooperatives:				
Multiunit	55	6.4	504,846	18.8
Single unit	138	16.0	386,690	14.4
Individual proprietors and partners	213	24.6	209,457	7.8
Total	865	100.0	2,685,350	100.0

Manufacturing Technology and Capacity

Technology

Most cheeses are manufactured from whole milk although skim milk, whey, or mixtures are used for certain types of cheese. Bacterial cultures are added to a vat of milk to increase the acidity and rennet or microbial enzyme milk coagulants are added to coagulate the milk. The coagulated milk is cut, stirred, and heated, the whey is drained off, and the curd is collected or pressed. Manufacturing techniques differ by cheese type regarding (1) the composition of milk used, (2) the type of bacteria or molds used in ripening, (3) the conditions of ripening such as temperature, humidity, and length of ripening, (4) the time and extent of whey expulsion, (5) the method used to cut and form or mold the curd, (6) the amount of and method used when adding the salt, (7) the degree and method of pressing, and (8) the color added.

In the manufacture of Cheddar cheese the curd is cut into small cubes, heated, and the whey is drained off. The curd is cheddared (matted and turned for texture). Finally, the cheese is milled (cut), salted, packed and pressed into a block, hoop, or put in a barrel.

Recent new manufacturing techniques have led to an increase in plant size. In the manufacture of Cheddar cheese the most important advance has been the automation of the various manufacturing steps (9). In the standard vat system, the cooking and cheddaring are completed in the same vat; in newer systems, the whey and curd are pumped to a smaller drain table for cheddaring. Other advances permit the cheddaring to be performed mechanically and the cheese to be automatically milled, salted, weighed and hooped. All of these techniques reduce labor and increase capital requirements, generally resulting in significant cost advantages (9).

Cheddar cheese production technology in 1973 was explored in the plant survey (table 14). The number of plants reporting was not sufficiently large to allow generalizations about all Cheddar cheese production, so only a summary for the survey is given.

The survey indicates the standard vat system dominates Cheddar cheese manufacture in the small plants. Even in the medium-sized plants only 18 out of 70 plants reported the adoption of any further automation. Since the overwhelming majority of all Cheddar cheese plants are in these two size groups, it seems the capital-intensive increased automation techniques have not been adopted by most plants in the industry. In contrast, the large plants in the survey reported much more automation. Given the cost advantages of automation, the larger plants seem to be at a comparative advantage in the production of Cheddar cheese.

Italian-type cheese is manufactured in as many ways as there are varieties. However, it generally requires a higher temperature than Cheddar. The curd is formed and stretched in hot water, placed in hoops in cold water, and immersed in salt brine. Ricotta is often manufactured from the Mozzarella whey.

The cheesemaker can retain more individuality manufacturing hard Italian-type cheese than Cheddar cheese. Consequently, adoption of new automated technology has been slower. For example, Italian-type cheesemaking has not utilized vertical vats. Hard Italian cheese manufacture requires a large capital investment for storage facilities to age the product.

However, there are some large Mozzarella cheese plants, because of the fast growth of the market. Major developments in the manufacture of Mozzarella are the use of larger vats, the introduction of direct salting of the curd instead of the use of brine, and the introduction of an automatic mixer-molder.

Table 14--Number of plants in survey reporting Cheddar cheese production technology

Region and technology <u>1/</u> <u>2/</u>	Plant size <u>3/</u>		
	Small	Medium	Large
	<u>Number</u>		
<u>Region 1</u>			
Standard vat:			
Manual hooping	28	24	1
Automatic weighing and hooping	1	3	1
Automatic milling, salting, weighing, and hooping	0	2	1
Two-tier vats:			
Manual hooping	0	0	0
Automatic weighing and hooping	0	1	3
Automatic milling, salting, weighing, and hooping	0	0	1
Automatic:			
Cheddaring	0	1	2
Cooking	0	0	1
Cooking and cheddaring	0	0	0
<u>Region 2</u>			
Standard vat:			
Manual hooping	9	9	3
Automatic weighing and hooping	0	3	2
Automatic milling, salting, weighing and hooping	0	0	1
Two-tier vats:			
Manual hooping	0	1	1
Automatic weighing and hooping	0	2	3
Automatic milling, salting, weighing, and hooping	0	0	1
Automatic:			
Cheddaring	0	0	2
Cooking	0	0	0
Cooking and cheddaring	0	1	1
<u>Region 3</u>			
Standard vat:			
Manual hooping	20	19	2
Automatic weighing and hooping	0	0	3
Automatic milling, salting, weighing and hooping	0	0	0
Two-tier vats:			
Manual hooping	0	0	0
Automatic weighing and hooping	0	3	2
Automatic milling, salting, weighing, and hooping	0	0	0
Automatic:			
Cheddaring	0	0	1
Cooking	0	0	0
Cooking and cheddaring	0	1	1

1/ See footnote 1, table 6.2/ The types of technology examined are taken from (9).3/ See footnote 2, table 6.

Swiss cheese has a firm, smooth body with distinctive "eyes" distributed throughout the cheese. These eyes are produced by specific bacterial cultures. They form in the warm room after the cheese is pressed and placed in a brine vat for 24 to 28 hours. The principal technological changes in the manufacture of Swiss cheese are the conversion from kettles to vats and from wheels to labor-saving, quicker aging 100- to 200-pound rindless blocks.

Capacity

The manufacturing capacity of the natural cheese industry was measured in the survey by the average number of cheese vats per plant and the total milk volume of the vats per plant (table 15). An average U.S. cheese plant in 1973 had four cheese vats and a total capacity of 58,700 pounds of milk. Therefore, there were approximately 3,460 vats in the cheese industry in 1973.

Both the average number of vats and volume per vat increase with plant size. Total vat volume per plant averaged 5.5 times greater for the large plants than for the small plants. Region 2, with about 94,000 pounds of milk volume, generally averaged a greater average vat volume per plant than the other regions, which had about 50,000 pounds each.

The cheese industry has undergone rapid changes in manufacturing facilities in recent years. The survey reported 123 out of 225 plants, about 55 percent, had some remodeling, expansion, or major improvements from 1971 through 1973. As previously noted, an initial consolidation movement of regional cooperatives in the Midwest improved operational efficiency with a few larger, well-located cheese plants. Many cooperative plants are now undergoing a second change toward cheese manufacturing facilities which emphasize flexibility among manufactured dairy products.

A survey of selected farm cooperatives conducted in 1974 on recent and proposed capacity changes reported 16 of 54 cooperatives recently expanded cheese capacity and no cooperatives decreased capacity. These 16 cooperatives contained a total of 35 generally large plants which had increased capacity. The primary reason listed for change was to gain manufacturing flexibility among manufactured dairy products. Also important was a response to the relatively higher price of cheese in recent years.

Much of the expansion in cheese manufacturing capacity was reported as either new cheese plants by cooperatives that also produce butter-powder or as conversion from butter-powder production. However, in many cases the butter-powder facilities were retained to permit a possible switch in response to price.

Given the recent emphasis on product flexibility in the new manufacturing capacity of many plants, the marketing advantages of price flexibility appear to increasingly offset the operational efficiency disadvantages of maintaining dual production facilities. This holds more for the regional cooperatives and less for local cooperatives with one plant, local privately owned companies, and national companies.

Cheese manufacturing has been more specialized than butter production since World War II. In 1961, 679 plants reported producing American-type cheese only, while 344 produced American-type cheese and other dairy products. Production of butter was reported in 153 American-type cheese plants (1).

The 225 plants in the cheese survey reported the manufacture of 98.7 million pounds of butter of which 78.5 million pounds was by cooperatively owned plants. Based on these results, an estimated 15 percent of the total U.S. butter production was manufactured in plants that also manufacture cheese.

Table 15--Average per plant number and volume of vats for all cheese, 1973

Region <u>1/</u>	Plant size <u>2/</u>							
	:Small		:Medium		:Large		:All sizes	
	Vats	Total milk : volume	Vats	Total milk : volume	Vats	Total milk : volume	Vats	Total milk : volume
	<u>Number</u>	<u>1,000 lbs.</u>	<u>Number</u>	<u>1,000 lbs.</u>	<u>Number</u>	<u>1,000 lbs.</u>	<u>Number</u>	<u>1,000 lbs.</u>
1	2.7	33.8	5.1	82.6	8.3	212.5	3.5	50.8
2	3.2	45.4	4.4	97.7	6.5	205.4	4.3	93.8
3	3.8	35.7	5.2	79.0	6.8	168.6	4.4	50.4
Total	3.2	35.9	5.0	85.4	7.1	194.9	4.0	58.7

1/ See footnote 1, table 6.

2/ See footnote 2, table 6.

Product Description

The survey reported the manufacture of several alternative cheese type or variety combinations within a plant. The manufacture of a single type or variety was reported in 127 American-type cheese plants, 34 Italian-type cheese plants, and 6 Swiss cheese plants.

A combination of manufacturing American-type cheese and at least one other type or variety was reported in an additional 39 plants. The dominant cheese in these combinations was often Italian-type or Swiss, with American-type accounting for only about 5 percent of that manufactured. Very few plants manufactured either Italian-type or Swiss in combination with any cheeses other than American-type.

The dominant styles in the manufacture of American-type cheese are bulk (500-pound barrel and 640-pound block combined) and 40-pound block. The plant survey indicated over 84 percent of 1973 American-type production was in these styles. Similarly, actual Wisconsin plant information for 1973 shows over 82 percent in these styles, although there was a relatively greater proportion of 40-pound blocks and a lesser proportion of bulk (table 16). These styles have generally increased in importance in the last 20 years while the other styles, notably Cheddar (70-75 pound wheels), have declined. The Cheddar style alone comprised almost 46 percent of American cheese manufactured in 1956 (19). The 640-pound blocks, which comprised a significant proportion of the bulk cheese, and the 40-pound blocks are commonly sold for use as natural cheese. In contrast, 500-pound barrels are commonly used for further processing.

For most plant sizes, the share of the production in the form of 40-pound blocks remained fairly constant, while bulk increased substantially with plant size. The

Table 16--Percent of plants producing natural American cheese styles, 1973

Cheese and approximate weight	Wisconsin, all size plants 1/	Total United States, by plant size 2/			
		Small	Medium	Large	All sizes
		<u>Percent</u>			
Longhorn, 12 lbs.	4.5	12.1	5.8	3.3	6.1
Daisy, 20 lbs.	1.6	7.6	2.2	.8	2.8
Midget, 10 lbs.	.9	2.8	.5	.0	.8
Cheddar, 72 lbs.	5.4	.8	1.2	.3	.8
Block, 20 and 60 lbs.	5.0	11.9	1.1	.1	2.9
Block, 40 lbs.	39.3	33.1	31.0	34.8	32.8
Bulk 3/	42.8	30.0	55.3	59.0	51.6
Other	.5	1.7	2.7	1.7	2.2
Total	100.0	100.0	100.0	100.0	100.0

1/ Wisconsin American Cheese Production, by Style-1973, Wis. Statis. Rptg. Serv.

2/ See footnote 2, table 6.

3/ Includes 500-pound barrels and 640-pound square containers.

other styles generally declined as a proportion of manufacture with increases in plant size.

The manufacture of a single style of American-type cheese was reported in 58 percent of the plants. The remaining plants reported manufacturing more than one style. One style commonly dominated these combinations with about 90-95 percent of manufacture.

Mozzarella cheese is primarily manufactured for industrial use in bulk as 5-, 6-, or 20-pound loaves, although some 40-pound loaves are manufactured for cutting and shredding. A smaller amount of Mozzarella is manufactured for retail sale in consumer-size packages. Hard Italian cheeses take many forms. Parmesan and Romano are most often in a 20-pound size, while Provolone is commonly manufactured in a rindless 10-pound size.

The dominant product type of Swiss cheese has changed from 250-pound wheels to 100- and 200-pound blocks. In 1973, Wisconsin reported over 97 percent of Swiss cheese manufactured as block (25).

Common styles of other cheese varieties include Muenster in 5-pound loaves or wheels, Brick in 5-pound brick-like shapes, and Blue in 5-pound wheels and also "crumbles" for institutional use. Cream and Limberger are packaged in retail forms at manufacture.

Whey Byproducts

The byproduct of natural cheese production is whey. Whey averages 93 percent water, 5.1 percent lactose, 0.9 percent protein, 0.5 percent ash, and 0.3 percent milkfat. The fat is separated out for further use in other food products. About 8 pounds of whey are produced for every pound of cheese.

Traditionally, whey has been considered an undesirable byproduct in the manufacture of cheese. Because it had little or no economic value, the least costly methods of disposal were often used. It was usually either dumped in a sewer or stream, or given to farmers to be fed to livestock or spread on fields as fertilizer.

However, there have been recent changes in farming methods, pollution standards, and the relative value of whey for food and feed uses (4,6,7,10,17). Less liquid whey is now returned to farmers because of the shift to bulk milk pickup at the farms and the high cost of operating return routes. Also, whey production is highest in the spring and summer, the period with the lowest number of hogs to be fed, and because of the weather and planting schedules, often the most difficult period to get into the fields. Hog producers now use more specialized equipment, use dry feed, and emphasize efficiency and sanitation, all contributing to the use of feeds other than liquid whey. Federal and State pollution standards have tightened and are more strictly enforced in recent years. Enforcement of these standards is confronting many cheese plants with a much greater cost in disposing of whey. Recent higher prices for nonfat dry milk and protein commodities as a result of shortages have improved the relative position of dry whey products as a food ingredient in the following items or processes: ice cream, process cheese foods and spreads, fortification of fluid milk products, baking, candy, meat processing, and other food products.

Those changes make it less practical to treat whey as a waste product. Consequently, there has been increased research to determine whey utilization alternatives. Drying whey requires a heavy capital investment and high operating costs, especially for fuel, which smaller cheese plants cannot generally justify. Also, an efficient size of whey-drying operation requires a greater volume of whey than most individual cheese

manufacturers produce. These reasons, combined with the high transportation costs of whey as a result of the high water content, make it economically necessary to either dry whey in large cheese plants or assemble liquid or condensed whey from a number of smaller cheese plants to a central drying plant. Therefore, a decision by one drying plant may affect a number of small cheese plants.

To lower transportation costs, the whey may be condensed before hauling for further processing. Condensing, which lowers the liquid content to about 60 percent, is relatively inexpensive and economically feasible for medium-sized to large cheese plants. After the whey has been condensed, it may be hauled to a drying plant up to 200 miles away in vehicles suitable for hauling fluid milk.

Whey may be dried by several techniques. Roller-drying was the most common method in the past and yields a relatively cheap product for animal feed uses. However, the emergence of stricter sanitary regulations and economic pressures have favored spray-drying, which produces a high quality, higher priced product for human consumption. Although spray-drying continues to be the most important drying method, new techniques in drying and processing are gaining in importance. Dried whey may return a small profit, but modified whey products including whey proteins, lactose, and blended and specialty products are more profitable.

In 1973, almost 54 percent of the whey from hard cheese plants was condensed, dried, or modified by the plant (table 17). Twenty-two percent was sold for further processing in liquid form and the rest, almost 25 percent, was fed or dumped. There was a significant difference in the uses of whey among plant sizes. Small plants dumped almost 65 percent of their whey while large plants dumped less than 7 percent. In contrast, large plants dried 38 percent of their whey while small plants dried about 6 percent. The proportion of whey sold for further processing declined as plant size increased.

INTERMEDIATE DISTRIBUTION OF NATURAL CHEESE

Distribution Channels

The intermediate distribution system for natural cheese is highly complex and must be viewed in terms of both the institutions involved and the functions performed at that level in the marketing channel. Cheese purchased from manufacturers is used as packaged natural cheese or process cheese products, or put into industrial (convenience foods such as cheese crackers and frozen pizzas) or institutional (such as pizza and cheeseburgers) products.

First, the cheese is assembled, which involves collecting the small diverse lots of cheese from individual manufacturers and sorting and aggregating them into larger uniform lots. Grading and storage may be included. All businesses performing these functions are referred to by the industry as "assemblers."

Few independent assemblers performing only the assembly functions remain in the industry. Wisconsin has around 50 assemblers but only about half a dozen are relatively small independent cheese assemblers. Independent assemblers are practically nonexistent outside Wisconsin. Most of the cheese they assemble is then sold to the processors and intermediate handlers who cut and package natural cheese for distribution to wholesalers and retailers.

The industry at this level has a high degree of vertical integration. The large cheese processors, who are also the most important intermediate handlers, originally bought cheese on the open market but they now assemble most of their cheese directly from factories through a variety of arrangements. Many obtain a large proportion of

Table 17--Whey disposition, 1973

Disposition	Plant size <u>1/</u>			
	Small	Medium	Large	All sizes
	<u>Percent</u>			
Sold for further processing	29.0	27.3	14.2	22.0
Condensed	.0	11.4	37.6	20.6
Dried	6.3	30.8	38.0	29.7
Modified	.0	4.7	3.6	3.4
Dumped in:				
Municipal sewer	10.8	5.5	1.9	4.9
Private sewage treatment plant	4.2	.8	.2	1.1
Lagoon	6.5	3.5	.0	2.5
Irrigation systems	2.9	6.9	2.8	4.5
Fed or used for fertilizer	40.3	9.1	1.7	11.3
Total	100.0	100.0	100.0	100.0

1/ See footnote 2, table 6.

their needs from their own plants or under informal sales agreements with private and cooperative manufacturers. These processors are the major market for most of the regional cooperatives.

The increased integration has reduced the number of levels the cheese must pass through in the market channel. As a result the assembly functions may be carried out at any level. They are often performed at the manufacturing level by multiplant cooperatives through a marketing office, by a group of small plants through a marketing cooperative, or by large private cheese manufacturers. At the other extreme these functions may be carried out by the buyers, processors, and intermediate handlers.

Before constructing a natural cheese plant, most businesses attempt to assure some stability in the future production and marketing of their product. They may seek the assistance of a processor to this end. "Processors in recent years have provided aids in starter management, supervision of factory operations, aid in manufacturing problems, and even advice in plant design and construction!" (11).

Agreements between processors and natural cheese manufacturing plants take many forms. The processors may be willing to take the entire output of selected manufacturers with a desirable quantity of cheese. They also may take some specified amount from some plants on a regular basis, and when supplies are tight, they may make arrangements with additional plants for specified quantities. Alternatively, when cheese supplies are abundant, assemblers may cut back on the amount of cheese they are willing to accept, in which case additional milk may be shifted into butter and powder. This may explain in part why the Government has bought relatively more butter and powder in the past under the price support program.

Table 18--First handler of cheese, 1973

Handler	Plant size ^{1/}				Total
	Small	Medium	Large	Percent	
Assembler	26.0	13.6	12.5	15.2	
Retail food chain	5.7	12.0	6.2	8.5	
National cheese company	26.8	41.5	45.1	40.5	
Wholesaler	29.1	17.6	16.9	19.3	
Marketing cooperative	7.4	3.5	10.2	7.0	
Broker	1.9	3.9	3.3	3.3	
Government	.0	.0	.0	.0	
Food company outside dairy	.1	3.2	.5	1.5	
Retail sales by plant	2.1	1.3	3.5	2.4	
Other	.9	3.4	1.8	2.3	
Total	100.0	100.0	100.0	100.0	

^{1/} See footnote 2, table 6.

The only cheese bought under an open offer under the price support program is in 40-pound blocks. However, the Government does provide an outlet for barrel cheese (in the form of process cheese, which is bought on a bid-basis) but no open-end commitment exists to buy process cheese. In recent years a number of plants have switched to the production of barrel cheese and cannot easily switch back to 40-pound blocks. Barrel cheese makes up a major portion of total Cheddar cheese production since it provides savings in manufacture and package costs. This weaker guaranteed market position in relation to butter places the cheese manufacturers at times in a relatively weaker bargaining position, and may explain the unwillingness of assemblers to accumulate unlimited quantities of barrel cheese.

Table 18 shows the route the cheese takes from the manufacturers' docks for further preparation for final distribution. In some cases, especially with a national cheese company, it may just move to another company-owned plant for further processing or cutting. The largest proportion, 40.5 percent, goes to national cheese companies. Wholesalers take 19.3 percent and assemblers, 15.2 percent. Very little cheese goes from the manufacturing plants directly to food companies outside the dairy industry even though they are substantial users of cheese. The assemblers in this table undoubtedly include some businesses that have primary functions other than assembly.

Functions at the Intermediate Distribution Level

In addition to assembly, cheese may go through several other steps in preparation for final utilization. These include cooling, testing for moisture and fat, grading, and weighing. All these functions may be partially performed at assembly. Other functions include storage, transportation, and cutting or processing.

Testing for moisture and fat is the basis for most of the pricing mentioned in the next section. In addition, most cheese is graded. The survey results for 1973 indicated 54 percent of all cheese was graded at the plant. Small plants had 31 percent of their cheese graded, medium-sized plants had 51 percent, and large plants had

Table 19--Average cheese storage capacity at all cheese plants, 1973

Region <u>1/</u>	Plant size <u>2/</u>			
	Small	Medium	Large	All sizes
		<u>1,000 pounds</u>		
1	37.8	623.3	2,042.7	262.5
2	64.9	387.3	1,955.1	522.4
3	188.6	516.0	2,384.4	406.3
Total U.S.	99.9	528.9	2,136.0	354.3

1/ See footnote 1, table 6.

2/ See footnote 2, table 6.

66 percent. American-type cheese was generally graded at the plant in the same proportions. Almost all Swiss cheese was graded at the plant.

Some types of cheese must be aged. Medium Cheddar cheese is usually aged 3-6 months and aged Cheddar usually a minimum of 6 months. In the Italian-type varieties, Mozzarella is not aged, but Parmesan must be aged at least 10 months, Romano 5 months, and Provolone 60 days. Swiss cheese must be aged at least 60 days.

Since this aging requires large capital investments in storage capacity, the cheese (except in some large plants) is not stored at the manufacturing level. However, the cheese, still warm after manufacture, is often cooled at the plant under controlled conditions until a shipment has been accumulated. It may then be further cooled by the assembler. Therefore, there is usually at least minimum storage capacity at the plant.

Average plant cheese storage capacity was about 354,000 pounds in 1973 (table 19). Capacity in all regions increased with plant size so that the large plants averaged 2.1 million pounds. Region 3 had relatively large cheese storage capacity through all plant sizes. Average capacity for all sizes was less for Region 3 than for Region 2 because Region 2 contained proportionately more large plants. American-type cheese plants generally had slightly lower cheese storage capacity than all cheese plants combined. Capacity at Swiss plants was about double the capacity of all cheese plants combined and at Mozzarella plants, about half that of all cheese plants combined.

The average number of days cheese was stored by the manufacturers reporting in the survey varied by cheese type. Cheddar cheese was stored an average of 34 days by smaller plants and almost 50 days by the largest plants. Storage for Colby increased with plant size from an average of 21 to 35 days. Stirred curd (500-pound barrels) was stored an average of 4 to 8 days. Almost all manufacturers stored Swiss cheese just over 60 days at the plant, until it was to be cut for distribution. Cheese is kept in the warm room for 35 to 40 days while the "eyes" form and the flavor develops. The plant needs to control environmental conditions. Mozzarella, a fresh, highly perishable Italian-type cheese, was stored at the plant an average of 4 to 9 days. However, plants manufacturing hard Italian-type cheeses reported an average of about 180 days for all plant sizes. Most of the hard Italian varieties manufactured are aged to be relatively mild.

Table 20--Transportation method and average distance from the manufacturer to the first handler, 1973

Item	Plant size <u>1/</u>			
	Small	Medium	Large	All sizes
	<u>Percent</u>			
Method of transportation:				
Truck	95	91	88	90
Rail	5	9	12	10
	<u>Miles</u>			
Distance to first handler:				
Average	161	350	351	318
Farthest	253	671	1,041	757

1/ See footnote 2, table 6.

Trucks transported 90 percent of the cheese from the manufacturers to the first handlers, with the remainder going by rail (table 20). Proportionately more of the cheese from the small plants went by truck, 95 percent, compared with the large plants, 88 percent.

Cheese was transported an average distance of 318 miles from the manufacturing plants to the handlers (table 20). On the average the farthest distance was 757 miles. The average distance to handlers was about the same for the medium-sized and large plants. This was especially true in Wisconsin and the West North Central Region, where the average distance to first handlers from the large plants was about 260 miles. The large plants are often operated as part of a totally integrated system with resulting efficiencies in distribution. The cheese in Wisconsin generally moved a shorter distance to the first handlers, especially cheese from the small plants, which went 77 miles.

Wholesale blocks of natural cheese distributed through the retail market are cut and packaged in retail units. Some of the retail cheese is cut in exact weights, packaged, and either "branded" with the distributor's label or "private labeled" with the name of the retailer. Other retail packages are in varying random weights and may or may not use the retailer's label.

Some cutting and packaging is done at all levels in the market channel, including the manufacturing plant, the intermediate distributor, and the chainstore warehouse. It is estimated that half of all manufacturing plants in Wisconsin cut and package at least part of their production for local distribution. However, national cheese companies and other intermediate handlers cut and package the greatest volume of natural cheese. Two of the major national cheese companies package primarily their own labels, whereas the other national companies perform both name branding and private label branding for retail chains. Cheese cutting at the retail level used to predominate but has declined with the introduction of rindless cheese block at wholesale and changing merchandising methods. Very few of the retail chains now even cut and package cheese at the wholesale level, although the number is increasing. The increase is partially due to the growth of the delicatessen department in stores. Cutting and packaging can give the retail chain greater control over the type of product merchandised.

Pricing at the Manufacturing Level

The Wisconsin Cheese Exchange, which meets weekly, provides a place for members to buy or sell American-type or Swiss cheeses (2). The purpose of the Exchange is not to provide an outlet for all cheese marketed. Although most of the cheese is marketed through direct long-term arrangements, the Exchange offers an alternative outlet and source as a safeguard for both buyers and sellers when an imbalance of cheese exists. Less than 1 percent of all cheese marketed is traded on the Exchange. Most sales are based on inspection by the buyer or Government grading.

The Exchange transactions provide a useful service as a basis of opinion on almost all cheese prices at the plant level. However, short-run market forces may bring prices paid to plants up relative to the Exchange during times of short supplies and down relative to the Exchange during times of abundant supplies. In addition, varieties of cheese such as Mozzarella, in which a greater proportion of the butterfat is separated out, are more sensitive to butter prices than others. High butter prices may result in relatively lower prices of Mozzarella cheese.

Price premiums may be based on age, moisture, fat, or flavor. Additional premiums on the basis of protein content are being considered by the industry. Forms of nonprice competition for plants include free supplies, such as boxes, salt, and barrels; free transportation; and technical aid in plant design, plant construction, and manufacturing.

MANUFACTURE OF PROCESS CHEESE

Description

Pasteurized process cheese is manufactured by grinding, heating, blending, and emulsifying natural cheese. A resulting uniform pasteurized process cheese with the desired properties is obtained by combining the natural cheeses of two or more lots on the basis of flavor, texture, body, age, acidity, and composition. Pasteurized process cheese foods and spreads are manufactured in the same way as pasteurized process cheese. Certain dairy products (cream, milk, skim milk, cheese whey, or whey albumin) may be used in addition to cheese in pasteurized process cheese foods and spreads. Pasteurized process cheese spreads contain more moisture and less fat than pasteurized process cheese and thus are more spreadable. The heat treatment used in the manufacture of all these process cheese products halts the ripening of the cheese and results in a longer shelf life.

The natural varieties most often used in pasteurized process cheese products are Cheddar, Colby, and Swiss. Small amounts of specialty cheeses may be used to obtain distinctive flavors. Italian cheeses have not been successfully processed. Fruits, vegetables, or meats may be added to any of the pasteurized process cheese products.

Cold pack cheese is manufactured by grinding and blending, either with very little or no heat, one or more lots of natural cheese.

Plants and Production Regions

The manufacturers of process cheese and other process cheese products have each maintained around 40 plants from 1960 to the present (table 21). There is some production overlap among plants, so the total number of plants making all process cheese products is somewhat less than the sum of manufacturers of the separate products. Average plant production has increased to 24 million pounds for process cheese and about half that for other process products.

Table 21--Number and average production of process cheese product plants, selected years, 1960-73

Years	Process cheese		Process spreads, cheese foods, and cold pack	
	Plants	Average plant production	Plants	Average plant production
	Number	1,000 pounds	Number	1,000 pounds
1960	41	11,270	45	5,020
1965	44	14,348	46	4,968
1970	40	17,160	40	11,290
1971	41	18,312	37	12,961
1972	41	18,164	42	10,845
1973	30	24,023	N.A.	N.A.

N.A. = Not available.

Sources: (18) and unpublished data, Econ. Res. Serv., U.S. Dept. Agr.

Process cheese manufacturers try to establish an even flow of natural cheese, to be as little dependent on variable surplus milk supplies as possible. Therefore, operations have been located near areas of high natural cheese production. Plants manufacturing natural cheese seldom manufacture process cheese. Process cheese production is heavily concentrated in Minnesota, Missouri, and Wisconsin. Other factors affecting plant location include proximity to markets, costs of transportation, and availability of skilled labor. As a result there is some process cheese manufacturing in the West, primarily Utah. There, in addition to local natural cheese supplies, some natural cheese is shipped in from the North Central Region for processing.

Organization

Process cheese manufacturing began over 55 years ago. Basic patents were initially held by a few businesses, with a limited number of other manufacturers licensed to operate under these patents. The original objectives of process cheese manufacturing were to approximate natural cheese while extending the keeping quality, uniformity, and slicing quality (11,12).

By the time the basic patents expired in 1938 the established manufacturers had attained good market position. Concentration has been maintained at this level by these early entrants partially by effective brand differentiation and competitiveness at the retail level, making entry into the national market by new brands difficult. When selling cheese using a retail store's name (private label) became a major method of marketing, these same businesses adjusted so that now almost all of these firms package under private labels for food chains as well as under their own labels.

Process cheese is manufactured by two different groups of plants. The first group generally consists of large plants serving their own trade and/or retail store brands over an extensive area. Most of them are owned by national cheese companies although some facilities are owned by regional cooperatives. They account for a high proportion of the total U.S. production of process cheese products.

These plants require a large capital investment and, because of low per-unit margins, a large volume. Therefore, they are usually tied in closely with the cutting

and packaging of natural cheese, though not necessarily by the same organization, so that the trim from cutting natural cheese to retail-sized units can be utilized. Also, small amounts of natural cheese with defects making it undesirable for natural sale may be blended with other natural cheese in processing without detracting from the quality of the finished product.

In the second group are many, often smaller, plants that cater to a specialized higher per-unit margin trade. With the higher margins, these plants are not as dependent on the trim from natural cheese cutting and may process only. However, they may have natural cheese outlets and process a small amount of natural cheese to achieve good product mix for customer appeal. They often service individual cheese stores, local food stores, and mail order outlets.

DISTRIBUTION OF NATURAL AND PROCESS CHEESE

Over 80 cheese companies, including importers, have national cheese distribution. About 40 of these are based in Wisconsin. Retail outlets take well over half of all cheese distributed. Institutional outlets are next in the share of distribution, while industrial outlets have the smallest share. Both institutional and industrial markets are increasing their share of total distribution. The increase in institutional markets, which now use a large share of the process cheese, is related to the growth of the fast food industry. The industrial market basically uses only natural cheeses.

Pricing at the wholesale level, as at the manufacturing level, is based in part on USDA reports on activity at the Wisconsin Cheese Exchange, specifically on the 40-pound block.

The retail cheese distribution system is similar to the total food distribution system. A few companies have representatives checking with individual stores. Most employ brokers to take orders in an area, sometimes in combination with regional company representatives. A few companies employ broker-distributors who have warehouses, trucks, and service individual stores in an area. The National Food Brokers Association listed 826 members in the United States in 1972/73 who deal in dairy products, cheeses, and margarine.

The greatest change in merchandising has been packaging for all types and varieties of cheese. There has been a trend to standard, high-quality, ready-packaged cheese portions which do not lose weight in storage or in the supermarket. Today almost 200 cheese items are displayed in retail grocery stores (13), compared with only 40 dairy products displayed 50 years ago. Chunk, wedge, or bulk were the most common package types for natural cheese, accounting for 80 percent of household purchases in 1972 (table 22). Process cheese products were most often purchased in sliced form.

The size of cheese packages purchased by households has generally increased for both natural and process cheeses from 1960 to 1972 (table 23). Packages of 8 ounces or less decreased from 36 to 19 percent of the total household purchases for natural cheese and from 64 to 19 percent for process cheese products. In contrast, the size group from 8.1 to 15.9 ounces increased from 32 to 47 percent for natural and from 10 to 34 percent for processed.

The brands of cheese purchased by households vary among types and varieties (table 24). Over 70 percent of natural cheeses and over 85 percent of process cheese products purchased are either a major brand or a chain private label. For Cream, Neufchatel, and Italian-type natural cheese, over 50 percent of purchases were major brands in 1972, while for Brick and Blue cheeses, a relatively greater proportion of purchases were of minor brand names.

Table 22--Household purchases by package type of natural and process cheeses, percent of volume, April-September 1972

Cheese type or variety	:Packaged--chunk: : wedge, bulk :	Packaged-- : sliced :	: Loaf/box:	: Other :	: Total
Natural					
American	: 90.0	9.5	--	0.5	100.0
Swiss	: 38.4	61.6	--	--	100.0
Brick	: 71.8	28.2	--	--	100.0
Muenster	: 52.8	47.2	--	--	100.0
Blue	: 88.3	--	--	11.7	100.0
Italian	: 54.3	17.5	--	28.2	100.0
Other	: 81.0	17.4	--	1.6	100.0
Total <u>1/</u>	: 77.9	18.9	--	3.2	100.0
Process					
American	: --	89.7	9.6	.7	100.0
Swiss	: --	94.9	1.5	3.6	100.0
Other	: --	--	--	--	100.0
Cheese food	: --	93.4	2.6	4.0	100.0
Cheese spread	: --	5.5	74.4	20.1	100.0
Total	: --	89.7	9.4	.9	100.0

1/ Does not include Cream cheese or Neufchatel cheese.

-- = 0.

Source: The Cheese Household Market, April-September 1972, Marketing and Economic Research Division, United Dairy Industry Association.

OTHER SOURCES OF CHEESE

Imported Cheese

Cheese imports in 1974 were the highest on record (table 25). This was partially due to a temporary increase of 100 million pounds for Cheddar cheese. The 1974 imports amounted to 10.9 percent of domestic cheese production.

Utilization

The only cheeses covered under the first quotas were Cheddar, Edam and Gouda, and Blue Mold, all for table use. In the 1960's the demand for processing cheeses increased in the United States, with a resulting rise in imports of cheeses for processing, and quotas were placed on these as well.

The American-type cheese imports are almost all used for further processing. The only major exception is aged Cheddar cheese, imported from Canada under the special 1.2 million pound quota, which is distributed through retail outlets for table use. Almost all Italian-type cheese imports are sold either in delicatessen or retail food-store outlets. Some is grated, but it is still sold through retail outlets. A small amount of Italian cheese from other sources is converted to institutional outlets. Edam and Gouda imports are practically all for retail sale. Blue Mold is primarily used in restaurants as an ingredient in foods such as salad dressings. A small amount

Table 23--Household purchases by package size of natural and process cheeses, percent of volume, April-September 1960 and 1972

Cheese type or variety	Less than 8 oz.		8 oz.		8.1-15.9 oz.		16 oz.		16.1-31.9 oz.		32 oz. and over		Total
	1960	1972	1960	1972	1960	1972	1960	1972	1960	1972	1960	1972	
	<u>Percent</u>												
<u>Natural</u>													
American	3.8	2.2	13.5	7.5	42.4	53.3	19.3	14.4	14.1	9.9	6.9	12.7	100.0
Swiss	17.1	10.9	32.9	24.6	21.1	34.1	12.8	20.0	9.4	4.3	6.7	6.1	100.0
Brick	5.2	6.3	16.0	15.5	39.6	54.9	15.2	11.2	16.7	3.9	7.3	8.2	100.0
Muenster	11.9	10.7	40.4	25.7	28.1	48.6	14.3	9.7	4.8	2.6	.3	2.7	100.0
Blue	50.0	48.2	8.4	21.7	28.4	15.7	7.8	8.3	2.7	6.2	2.7	.5	100.0
Italian	N.A.	17.3	N.A.	32.7	N.A.	17.3	N.A.	20.5	N.A.	6.0	N.A.	6.2	100.0
Total <u>1/</u>	13.0	6.0	22.6	13.1	32.0	46.6	15.3	15.2	10.8	8.5	6.3	10.6	100.0
<u>Process</u>													
American	13.5	3.6	46.1	12.9	10.3	35.0	10.8	18.8	1.9	8.0	17.4	21.7	100.0
Swiss	25.1	17.4	57.6	55.0	7.6	17.2	5.8	9.5	2.5	.9	1.4	--	100.0
Other	18.1	17.9	61.9	11.9	9.0	23.6	1.8	16.3	2.5	27.6	6.7	2.7	100.0
Cheese food	7.0	4.9	6.4	8.8	1.4	59.7	3.9	15.7	.2	7.2	81.1	3.7	100.0
Cheese spread	8.9	8.7	10.2	7.7	.6	4.4	13.9	13.1	1.5	--	64.9	66.0	100.0
Total	15.0	4.2	49.2	14.3	9.9	34.2	9.1	18.6	2.1	8.0	14.7	20.7	100.0

N.A. = Not available; -- = 0.

1/ Total in 1972 does not include Cream cheese or Neufchatel cheese.

Source: The Household Cheese Market, April-September 1960, Marketing Research Department, American Dairy Association and The Cheese Household Market, April-September 1972, Marketing and Economic Research Division, United Dairy Industry Association.

Table 24--Household purchases by brand of natural and process cheeses, percent of volume, April-September 1972

Cheese type or variety	: Major brands <u>1/</u>	: Chain private label	: Independent private label	: All other brands	: Total
			<u>Percent</u>		
Natural					
American	: 36.6	33.8	1.9	27.7	100.0
Swiss	: 47.7	29.4	2.0	23.9	100.0
Cream	: 68.1	25.7	.3	5.9	100.0
Neufchatel	: 83.2	10.3	--	6.5	100.0
Brick	: 31.9	29.2	3.4	35.5	100.0
Muenster	: 29.6	42.5	2.5	25.4	100.0
Blue	: 32.4	24.2	1.6	41.8	100.0
Italian	: 57.4	18.4	.7	23.5	100.0
Total <u>2/</u>	: 39.5	31.5	1.8	27.2	100.0
Process					
Cheese	: 53.3	30.1	1.2	15.4	100.0
Cheese food	: 67.4	21.0	.9	10.8	100.0
Cheese spread	: 80.0	6.7	1.0	12.3	100.0
Total	: 65.4	20.3	1.1	13.2	100.0

-- = 0.

1/ Includes all brands exceeding 1 percent of U.S. total volume.

2/ Does not include Cream cheese or Neufchatel cheese.

Source: The Cheese Household Market, April-September 1972, Marketing and Economic Research Division, United Dairy Industry Association.

Table 25--Cheese imports by type, 1970-74

Product	1970	1971	1972	1973	1974 <u>1/</u>
	<u>Thousand pounds</u>				
Cheese, quota types					
American:					
Cheddar	10,132	9,324	9,516	20,010	107,017
Other	5,969	7,624	5,959	8,430	5,101
Italian:					
Original loaves	6,617	6,458	10,802	10,524	8,982
Other	674	852	1,350	1,517	1,185
Edam and Gouda:					
(Natural and process)	11,799	10,126	10,146	11,596	9,371
Blue mold	4,766	4,485	4,434	5,994	5,015
Swiss:					
Emmenthaler <u>2/</u>	3,592	2,533	11,235	24,875	12,565
Gruyere (process) <u>2/</u>	3,149	2,720	4,499	9,936	6,191
Other:					
Over 0.5% fat <u>2/</u>	23,371	15,701	32,225	52,477	34,452
Under 0.5% fat	10,753	7,580	8,397	11,965	7,860
Total	80,410	67,403	98,563	157,324	197,739
Cheese, nonquota types					
Swiss:					
Emmenthaler <u>3/</u>	22,763	21,784	22,337	24,725	51,297
Gruyere (process) <u>3/</u>	10,800	8,879	8,287	5,703	9,113
Other <u>3/</u>	22,634	17,961	23,275	21,241	37,698
Pecorino	20,621	16,566	22,976	17,215	16,465
Roquefort	2,063	1,671	2,543	2,126	1,439
Other	1,585	1,663	1,508	1,466	1,908
Total	80,463	68,524	80,926	72,476	117,920

1/ Preliminary.

2/ Below pricebreak.

3/ Above pricebreak.

Source: Dairy Situation, Econ. Res. Serv., U.S. Dept. Agr.

is sold at retail. Swiss cheese is used for both retail sale and for further processing. Almost all coming under a certain price is used for further processing. The other cheeses go into further processing. A large portion of this is Mozzarella which goes to the pizza trade.

Structure

Import licenses were issued to 312 persons or firms by USDA's Foreign Agricultural Service as of January 1, 1974. The major importers of cheeses used for further processing are the large domestic cheese processors. The many smaller importers, which are usually food brokers, sell most of their imported cheese to these same processors.

Imported cheese which is sold in natural form at the retail market is primarily imported by food brokers which distribute to food chains and other retail outlets. A

small part is imported by gourmet shops for their own distribution.

Cheese Analogs

Synthetic cheeses are not a major factor in the market at present and are not expected to be in the near future. The quantity of milk which might be replaced by cheese analogs in 1980 has been estimated at the medium level of penetration to be 675 million pounds and the highest level of penetration to be 2,252 million pounds (5).

Cheese analogs simulate cheese or cheese products but the milk components are either wholly or partially replaced in their manufacture. The protein substance, calcium caseinate, which may be used in the manufacture of cheese analogs is considered a dairy-derived product. Synthetic cheese products are illegal in about three-fourths of the States.

Most of the recent industry research on substitute cheeses has concentrated on institutional and industrial use. The major problems to overcome for these products are nutritional equivalency, taste, and appearance. Synthetic cheese products appear to be highly price sensitive. During one recent period of high cheese prices there was much research activity in the area, but with a price decline this activity slackened. Continuing high prices of vegetable oils, a potential source of ingredients, would probably dampen research activity.

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APPENDIX A--TABLES

Table A.1--Utilization of total milk supply in total manufactured dairy products and cheese, 1960-73

Year	Total milk supply		Utilization (milk equivalent) 1/							
	Mil. lbs.	Pct.	Total manufactured products	American cheese		Other cheese		Total cheese		
	Mil. lbs.	Pct.	Mil. lbs.	Pct.	Mil. lbs.	Pct.	Mil. lbs.	Pct.	Mil. lbs.	Pct.
1960	123,102	48.5	59,751	9,686	7.9	3,678	3.0	13,364	10.9	
1961	125,734	50.6	63,580	11,179	8.9	3,682	2.9	14,861	11.8	
1962	126,325	50.8	64,141	10,689	8.5	3,652	2.9	14,341	11.4	
1963	125,335	50.0	62,667	10,920	8.7	3,890	3.1	14,810	11.8	
1964	127,020	50.8	64,538	11,454	9.0	4,162	3.3	15,616	12.3	
1965	124,339	49.7	61,768	11,458	9.2	4,277	3.4	15,735	12.7	
1966	121,283	47.7	57,900	12,154	10.0	4,521	3.7	16,675	13.7	
1967	120,109	49.8	59,770	12,701	10.6	4,507	3.8	17,208	14.3	
1968	117,421	50.4	59,230	12,716	10.8	4,660	4.0	17,376	14.8	
1969	116,402	50.1	58,315	12,668	10.9	4,948	4.2	17,616	15.1	
1970	117,493	51.1	59,992	14,226	12.1	5,330	4.5	19,556	16.6	
1971	118,725	51.8	61,492	15,127	12.1	5,820	4.9	20,947	17.6	
1972	120,468	51.7	62,287	16,329	13.6	6,439	5.3	22,768	18.9	
1973 <u>2/</u>	115,441	51.0	58,898	16,541	14.3	6,619	5.7	23,160	20.1	

1/ Milk equivalent is computed by dividing the milkfat in the product by the yearly average butterfat test of whole milk sold by farmers.

2/ Unrevised.

Source: Milk Production, Disposition, and Income, Statis. Rptg. Serv., U.S. Dept. Agr.

Table A-2--Production of all natural cheese, annual and quarterly, 1960-74

Year	First quarter	Second quarter	Third quarter	Fourth quarter	Total	Annual index
	----- <u>Thousand pounds</u> -----					<u>1960=100</u>
1960	328,980	449,406	363,397	336,190	1,477,973	100
1961	377,977	499,861	403,822	352,845	1,634,505	111
1962	362,399	481,195	397,448	350,980	1,592,022	108
1963	357,713	496,719	414,891	362,494	1,631,817	110
1964	402,263	509,362	421,197	390,814	1,723,636	117
1965	417,341	528,844	433,594	375,677	1,755,456	119
1966	418,543	544,065	460,867	430,527	1,854,002	125
1967	459,796	557,993	473,687	427,354	1,918,830	130
1968	454,821	576,020	481,172	426,195	1,938,208	131
1969	444,149	572,593	503,867	468,980	1,989,589	135
1970	514,876	626,131	543,639	516,782	2,201,428	149
1971	549,306	676,764	587,643	560,602	2,374,315	161
1972	619,052	737,541	654,569	593,443	2,604,605	176
1973 <u>1/</u>	629,228	774,098	640,257	641,767	2,685,350	182
1974 <u>1/</u>	742,896	822,089	692,416	640,535	2,897,936	196

1/ Unrevised.

Sources: Production of Manufactured Dairy Products, Statis. Rptg. Serv., U.S. Dept. Agr., and Dairy Products, Statis. Rptg. Serv., U.S. Dept. Agr.

Table A.3--Production of American-type cheese, annual and quarterly, 1960-74

Year	First quarter	Second quarter	Third quarter	Fourth quarter	Total	Annual index
	----- <u>Thousand pounds</u> -----					<u>1960=100</u>
1960	208,655	322,674	252,177	212,612	996,118	100
1961	254,890	369,043	295,046	229,782	1,148,761	115
1962	239,081	354,458	280,592	220,356	1,094,487	110
1963	232,114	358,877	291,744	225,616	1,108,351	112
1964	260,673	364,309	288,983	243,346	1,157,311	116
1965	272,483	373,463	291,211	221,128	1,158,285	116
1966	257,999	377,172	311,103	274,063	1,220,337	123
1967	303,185	394,262	319,424	259,468	1,276,339	128
1968	293,871	400,878	322,471	256,596	1,273,816	128
1969	273,964	385,633	327,984	278,847	1,266,428	127
1970	328,093	428,906	355,394	311,006	1,423,399	143
1971	344,185	458,249	380,872	328,202	1,511,508	152
1972	381,894	491,106	424,435	346,852	1,644,287	165
1973 <u>1/</u>	383,737	499,017	402,946	386,815	1,672,515	168
1974 <u>1/</u>	487,644	547,347	431,843	365,299	1,832,133	184

1/ Unrevised.

Sources: Production of Manufactured Dairy Products, Statis. Rptg. Serv., U.S. Dept. Agr., and Dairy Products, Statis. Rptg. Serv., U.S. Dept. Agr.

Table A.4--Production of Italian-type cheese, annual and quarterly, 1960-74

Year	First quarter	Second quarter	Third quarter	Fourth quarter	Total	Annual index
	----- <u>Thousand pounds</u> -----					<u>1960=100</u>
1960	40,231	42,146	35,103	40,053	157,533	100
1961	42,629	43,388	34,881	40,901	161,799	103
1962	42,956	45,646	39,774	43,616	171,992	109
1963	45,179	50,851	44,852	51,346	192,228	122
1964	56,818	56,579	51,437	54,884	219,718	139
1965	59,513	64,966	57,436	62,555	244,470	155
1966	68,474	72,849	62,159	67,637	271,119	172
1967	71,802	73,891	66,791	71,972	284,456	181
1968	78,134	83,464	74,836	78,421	314,855	200
1969	85,671	95,136	87,321	93,126	361,254	229
1970	96,465	99,593	93,927	103,683	393,668	250
1971	108,879	117,700	108,195	119,087	453,861	288
1972	130,701	135,655	121,854	123,933	512,143	325
1973 <u>1/</u>	133,725	154,548	131,926	145,071	565,270	359
1974 <u>1/</u>	145,501	155,184	144,187	156,412	601,284	382

1/ Unrevised.

Sources: Production of Manufactured Dairy Products, Statis. Rptg. Serv., U.S. Dept. Agr., and Dairy Products, Statis. Rptg. Serv., U.S. Dept. Agr.

Table A.5--Production of Swiss cheese, annual and quarterly, 1960-74

Year	First quarter	Second quarter	Third quarter	Fourth quarter	Total	Annual index
	----- <u>Thousand pounds</u> -----					<u>1960=100</u>
1960	27,282	34,765	31,755	27,279	121,081	100
1961	29,116	36,751	29,210	25,431	120,508	100
1962	26,587	31,179	27,212	24,434	109,412	90
1963	26,741	35,804	31,613	25,748	119,906	99
1964	27,380	35,652	31,442	27,370	121,844	101
1965	28,386	35,200	31,429	27,717	122,732	101
1966	32,425	40,068	35,810	28,361	136,664	113
1967	28,773	36,679	36,078	30,674	132,204	109
1968	31,004	37,065	33,739	27,805	129,613	107
1969	29,354	37,294	33,787	31,177	131,612	109
1970	32,594	40,387	37,934	33,042	143,957	119
1971	33,829	41,868	39,418	38,728	153,843	127
1972	40,702	46,906	45,229	44,936	177,773	147
1973 <u>1/</u>	43,390	48,585	39,059	33,187	164,221	136
1974 <u>1/</u>	43,710	49,645	47,032	41,523	181,910	150

1/ Unrevised.

Sources: Production of Manufactured Dairy Products, Statis. Rptg. Serv., U.S. Dept. Agr., and Dairy Products, Statis. Rptg. Serv., U.S. Dept. Agr.

Table A.6--Production of Cream and Neufchatel cheeses, annual and quarterly, 1960-74

Year	First quarter	Second quarter	Third quarter	Fourth quarter	Total	Annual index
----- Thousand pounds -----						1960=100
1960	28,490	24,164	22,255	31,528	106,437	100
1961	27,369	26,221	23,376	32,547	109,513	103
1962	29,710	25,780	28,280	37,918	121,688	114
1963	29,223	26,791	24,840	34,561	115,415	108
1964	30,003	27,002	25,299	37,880	120,184	113
1965	29,359	27,625	27,956	37,769	122,709	115
1966	30,333	24,397	25,651	36,003	116,384	109
1967	30,051	26,069	26,961	38,573	121,654	114
1968	27,296	27,885	25,872	37,806	118,859	112
1969	28,717	27,374	27,963	39,528	123,312	116
1970	30,219	27,565	27,958	40,356	126,098	118
1971	32,487	26,447	29,079	41,816	129,829	122
1972	31,277	28,651	29,535	43,795	133,258	125
1973 <u>1/</u>	31,097	33,379	32,308	42,880	139,664	131
1974 <u>1/</u>	30,777	35,246	34,519	45,564	146,106	137

1/ Unrevised.

Sources: Production of Manufactured Dairy Products, Statis. Rptg. Serv., U.S. Dept. Agr., and Dairy Products, Statis. Rptg. Serv., U.S. Dept. Agr.

Table A.7--Production of other natural cheese, annual and quarterly, 1960-74

Year	First quarter	Second quarter	Third quarter	Fourth quarter	Total	Annual index
	----- <u>Thousand pounds</u> -----					<u>1960=100</u>
1960	24,322	25,657	22,107	24,718	96,804	100
1961	23,973	24,458	21,309	24,184	93,924	97
1962	24,065	24,132	21,590	24,656	94,443	98
1963	24,456	24,396	21,842	25,223	95,917	99
1964	27,389	25,820	24,036	27,334	104,579	108
1965	27,600	27,590	25,562	26,508	107,260	111
1966	29,312	29,579	26,144	24,463	109,498	113
1967	25,985	27,092	24,433	26,667	104,177	108
1968	24,516	26,728	24,254	25,567	101,065	104
1969	26,443	27,156	26,812	26,572	106,983	111
1970	27,505	29,680	28,426	28,695	114,306	118
1971	29,926	32,500	30,079	32,769	125,274	129
1972	34,478	35,223	33,516	33,927	137,144	142
1973 <u>1/</u>	37,279	38,569	34,018	33,814	143,680	148
1974 <u>1/</u>	35,264	34,667	34,835	31,737	136,503	141

1/ Unrevised.

Sources: Production of Manufactured Dairy Products, Statis. Rptg. Serv., U.S. Dept. Agr., and Dairy Products, Statis. Rptg. Serv., U.S. Dept. Agr.

Table A.8--Production of process cheese products, 1960-73

Year	Process cheese		Process cheese foods, spreads, and cold pack	
	Production	Index	Production	Index
	<u>Thou. lbs.</u>	<u>1960=100</u>	<u>Thou. lbs.</u>	<u>1960=100</u>
1960	462,090	100	225,878	100
1961	509,333	110	221,727	98
1962	644,661	140	228,161	101
1963	661,730	143	210,133	93
1964	659,667	143	207,990	92
1965	631,312	137	228,517	101
1966	621,787	135	262,436	116
1967	724,301	157	285,885	127
1968	643,723	139	327,547	145
1969	650,161	141	367,195	163
1970	686,383	149	451,614	200
1971	750,772	162	479,553	212
1972	744,728	161	455,496	202
1973	720,690	156	441,777	196

Source: Production of Manufactured Dairy Products, Statis. Rptg. Serv., U.S. Dept. Agr.

Table A.9--Imports of all cheese, annual and quarterly, 1960-74

Year	First quarter	Second quarter	Third quarter	Fourth quarter	Total	Imports as proportion of total annual natural cheese production
	<u>Thousand pounds</u>					<u>Percent</u>
1960	13,745	13,902	12,857	22,644	63,148	4.3
1961	19,691	19,300	15,792	21,039	75,822	4.6
1962	17,726	20,348	15,334	24,108	77,516	4.9
1963	19,386	24,436	14,598	25,680	83,100	5.2
1964	19,716	18,616	15,061	24,440	77,833	4.5
1965	17,191	21,237	13,765	27,117	79,310	4.5
1966	29,715	23,978	30,759	50,987	135,439	7.3
1967	46,690	46,489	26,833	31,768	151,780	7.9
1968	27,311	37,164	66,408	39,366	170,249	8.8
1969	21,558	38,037	32,120	52,386	144,101	7.2
1970	37,730	31,745	33,687	57,776	160,938	7.3
1971	29,469	34,741	42,369	29,348	135,927	5.9
1972	43,737	33,118	44,552	58,083	179,490	6.9
1973	41,361	48,539	58,507	81,393	229,800	8.6
1974 <u>1/</u>	148,430	48,925	48,759	69,545	315,659	10.9

1/ Unrevised.

Source: Bureau of the Census, U.S. Dept. Commerce.

Table A.10--Imports of American-type cheese, annual and quarterly, 1960-74

Year	First quarter	Second quarter	Third quarter	Fourth quarter	Total	Imports as proportion of total annual natural American-type production
	<u>Thousand pounds</u>					<u>Percent</u>
1960	1,868	2,339	243	2,646	7,096	.7
1961	6,498	5,446	3,258	2,108	17,310	1.5
1962	3,721	5,614	745	3,869	13,949	1.3
1963	4,633	6,811	1,175	5,470	18,089	1.6
1964	4,855	3,572	596	3,713	12,736	1.1
1965	5,822	4,503	702	4,980	16,007	1.4
1966	11,709	5,988	12,544	19,898	50,139	4.1
1967	24,504	22,658	6,746	6,441	60,349	4.7
1968	2,226	3,059	2,763	7,655	15,703	1.2
1969	1,883	3,481	2,143	8,130	15,637	1.2
1970	4,383	1,403	816	9,048	15,650	1.1
1971	3,899	1,881	4,058	7,109	16,948	1.1
1972	2,342	1,550	4,038	7,542	15,472	.9
1973	4,268	8,157	6,228	9,787	28,440	1.8
1974 <u>1/</u>	94,943	5,916	833	10,426	112,118	6.1

1/ Unrevised.

Source: Bureau of the Census, U.S. Dept. Commerce.

Table A.11--Imports of Italian-type cheese, annual and quarterly, 1960-74 1/

Year	First quarter	Second quarter	Third quarter	Fourth quarter	Total	Imports as proportion of total annual natural Italian- type production
----- <u>Thousand pounds</u> -----					<u>Percent</u>	
1960	3,954	3,972	3,434	8,641	20,001	12.7
1961	5,294	5,798	4,221	7,337	22,650	14.0
1962	6,483	6,291	5,524	8,746	27,044	15.7
1963	7,091	7,940	4,379	8,872	28,282	14.7
1964	4,889	6,266	5,571	8,875	25,601	11.7
1965	4,664	5,921	4,533	8,569	23,687	9.7
1966	5,604	4,828	4,120	9,437	23,989	8.9
1967	6,117	7,397	4,883	7,258	25,655	9.0
1968	4,956	5,713	6,120	10,007	26,796	8.5
1969	5,896	8,845	7,172	9,601	31,514	8.7
1970	7,244	6,582	5,646	8,449	27,921	7.1
1971	7,070	6,385	6,366	4,053	23,876	5.3
1972	11,070	6,722	7,114	10,121	35,128	6.8
1973	6,988	7,355	5,916	8,997	29,255	5.2
1974 <u>2/</u>	7,988	5,818	4,754	8,071	26,631	4.4

1/ Includes Romano, Pecorino, Reggiano, Parmesano, Provolini, and Provelette.

2/ Unrevised.

Source: Bureau of the Census, U.S. Dept. Commerce.

Table A.12--Imports of Swiss cheese, annual and quarterly, 1960-74 1/

Year	First quarter	Second quarter	Third quarter	Fourth quarter	Total	Imports as proportion of total annual natural swiss production
	----- Thousand pounds -----					Percent
1960	3,069	2,950	3,853	4,814	14,686	12.1
1961	3,145	3,424	4,157	5,108	15,834	13.1
1962	3,406	3,500	4,441	5,977	17,324	15.8
1963	3,464	3,694	4,197	5,235	16,590	13.8
1964	3,857	3,566	4,338	4,921	16,682	13.7
1965	2,574	4,019	3,562	5,579	15,734	12.8
1966	4,826	4,431	6,031	8,555	23,843	17.5
1967	5,518	5,335	6,205	7,132	24,190	18.3
1968	8,578	14,249	28,841	7,161	58,829	45.4
1969	4,982	7,247	9,521	11,007	32,757	24.9
1970	9,060	7,757	10,709	12,778	40,304	28.0
1971	8,927	8,580	12,628	5,781	35,917	23.4
1972	12,386	8,179	11,535	14,258	46,358	20.5
1973	12,758	12,671	17,229	22,581	65,240	39.6
1974 <u>2/</u>	21,434	18,783	20,389	18,561	79,167	43.5

1/ Includes Emmenthaler and Gruyere.

2/ Unrevised.

Source: Bureau of the Census, U.S. Dept. Commerce.

Table A.13--Ending commercial stocks of all cheese, quarterly, 1960-74

Year	First quarter	Second quarter	Third quarter	Fourth quarter	Fourth quarter stocks as proportion of total annual natural cheese production
	<u>Thousand pounds</u>				<u>Percent</u>
1960	261,835	345,165	346,189	332,594	23
1961	341,084	452,351	501,192	472,935	29
1962	417,184	496,975	493,088	422,079	27
1963	343,391	415,996	407,918	340,701	21
1964	301,743	381,780	363,486	325,952	19
1965	292,384	378,689	386,639	308,562	18
1966	275,680	369,654	398,366	372,668	20
1967	367,365	438,580	439,466	390,289	20
1968	351,404	420,751	447,267	380,963	20
1969	315,033	366,081	369,468	317,535	16
1970	286,192	368,256	363,534	324,483	15
1971	302,127	371,344	357,589	304,268	13
1972	287,316	376,294	404,010	331,444	13
1973	302,438	374,167	382,260	357,808	13
1974	438,855	570,739	539,087	493,955	17

Source: Regional Cold Storage Holdings, Statis. Rptg. Serv., U.S. Dept. Agr.

Table A.14--Ending commercial stocks of American-type cheese, 1960-74

Year	First quarter	Second quarter	Third quarter	Fourth quarter	Fourth quarter stocks as proportion of total annual natural American-type production
	<u>Thousand pounds</u>				<u>Percent</u>
1960	228,222	304,111	304,237	292,011	29
1961	302,349	400,283	442,236	419,914	37
1962	367,823	454,493	457,107	384,246	35
1963	309,303	373,915	363,863	301,631	27
1964	264,035	339,213	318,580	283,647	25
1965	252,314	333,187	340,579	270,988	23
1966	235,378	321,116	347,081	322,248	26
1967	317,936	384,838	386,106	344,047	27
1968	303,457	370,130	376,042	318,676	25
1969	260,180	307,021	309,034	265,438	21
1970	238,899	313,200	290,679	253,984	18
1971	236,281	296,402	283,674	238,900	16
1972	226,707	307,789	335,777	269,438	16
1973	244,955	307,527	310,507	290,299	17
1974	363,792	486,543	462,999	420,838	23

Source: Regional Cold Storage Holdings, Statis. Rptg. Serv., U.S. Dept. Agr.

Table A.15--Ending commercial stocks of Swiss cheese, quarterly, 1960-74

Year	First	Second	Third	Fourth	Fourth quarter
	quarter	quarter	quarter	quarter	stocks as proportion of total annual natural Swiss production
----- <u>Thousand pounds</u> -----					<u>Percent</u>
1960	9,557	9,681	11,476	11,782	10
1961	12,070	18,076	21,457	16,728	14
1962	15,723	12,416	11,631	7,640	7
1963	7,990	9,540	12,299	10,270	9
1964	9,404	10,817	11,048	8,805	7
1965	8,870	9,422	9,851	6,720	5
1966	8,330	11,983	13,991	12,405	9
1967	12,101	12,662	13,345	10,987	8
1968	10,687	12,220	15,908	16,054	12
1969	11,764	11,562	12,590	10,313	8
1970	10,472	9,835	10,744	12,644	9
1971	11,599	10,614	10,594	7,191	5
1972	7,103	8,926	9,322	8,122	5
1973	8,713	12,612	15,351	13,393	8
1974	15,891	13,837	13,810	15,130	8

Source: Regional Cold Storage Holdings, Statis. Rptg. Serv., U.S. Dept. Agr.

Table A.16--CCC purchases of Cheddar cheese, on a delivery basis

Calendar year	Bulk <u>1/</u>	Process	
		709 section	Price support
		<u>Thousand pounds</u>	
1960	267	--	--
1961	78,225	--	21,864
1962	113,853	--	100,433
1963	19,797	--	93,348
1964	25,785	--	103,527
1965	10,740	--	38,192
1966	--	10,820	--
1967	45,798	4,434	130,234
1968	17,452	--	70,661
1969	198	7,459	22,210
1970	3,614	6,048	39,279
1971	2,747	5,309	82,622
1972	--	--	30,375
1973	--	1,176	2,016
1974 <u>2/</u>	4,827	1,008	51,982

-- = None purchased.

1/ Prior to July 1961, all purchases were in bulk form.

2/ An additional 2,485,000 pounds were purchased under Section 4(a) of the Agriculture and Consumer Protection Act of 1973.

Source: Agr. Stabilization and Conservation Serv., U.S. Dept. Agr.

Table A.17--Cheese quotas, calendar year 1974

Cheese	Quota
	<u>Thousand pounds</u>
American:	
Cheddar	10,037.5
Other	6,096.6
Edam and Gouda:	
Natural	9,200.4
Processed	3,151.0
Blue Mold	5,017.0
Italian:	
Original loaves	11,500.1
Other	1,494.0
Swiss or Emmenthaler <u>1/</u>	20,420.0
Gruyere (process) <u>1/</u>	11,242.0
Other cheeses and substitutes <u>1/</u> :	
Over 0.5% butterfat	40,730.0
0.5% or less butterfat	<u>8,901.0</u>
Subtotal	127,789.6
Temporary quota of 100 million pounds for Cheddar for the period beginning January 3, 1974, and ending March 31, 1974.	<u>100,000.0</u>
Total	227,789.6

1/ Includes all cheese less than "pricebreak". The pricebreak is the Commodity Credit Corporation purchase price for Cheddar cheese, rounded to the nearest whole cent, plus 7 cents.

APPENDIX B--SAMPLE AND SURVEY PROCEDURE

All U.S. cheese manufacturing plants were stratified into three groups based on annual cheese production. The plant size groups in thousand pounds of annual production were: Small (less than 2,000), medium (2,000-9,999), and large (10,000 and greater). The initial sample allocation was based on the number of plants in each size group. The plants were then arrayed by major types of cheese production within the plant size groups for each State. A plant was classified by cheese type if 80 percent or more of annual production in 1973 was of that type. Other plants were classified as mixed types if the production of no single type of cheese predominated. The cheese types were American, Italian, Swiss, other, and mixed cheeses.

From these arrays a sampling interval and random start were determined to select a systematic random sample. This ensured a proportional representation of all type plants. All plants in the large plant size strata were selected for the sample.

A survey of these sample cheese manufacturing plants was conducted by mail questionnaire during March and April, 1974. The questionnaire was sent to a sample of 316 plants out of a population of 901 plants in 1972 (see tables B.1, B.2). The National Cheese Institute aided in constructing the questions. The initial mailing was followed by a second mailing one week later. A nonresponse sample was conducted in the third week using the same sampling techniques, followed by a telephone reminder call. Of the 225 usable questionnaires returned, 15 were from the nonresponse sample.

The sample plants were grouped into three regions for reporting the results in some sections of the bulletin. For a complete plant description, data from the questionnaire were combined with plant production data reported annually. The identity of the individual plants was kept confidential for both the questionnaire results and the production data. Annual production was reported for American cheese, Italian cheese, Swiss cheese, other cheese, butter, condensed products, dry milk, other manufactured products, and total milk received. The sample allocation and sample frame are based on 1972 data listing plants by size, although all data reported are for 1973.

The plants in the sample produced 1,559 million pounds of cheese in 1973 (58.1 percent of the 1973 total U.S. production). The sample American plants produced 999 million pounds (59.8 percent), the sample Swiss plants, 128 million pounds (78.0 percent), and the sample Italian plants, 274 million pounds (48.5 percent).

The results were reported in one of three different forms based on sample data limits and usefulness. In the first form, summary data from only the survey plants were reported. There were either too few plants in the sample to draw any generalizations here, or the weights were unavailable to expand the data.

In the second form, average per plant data were reported using weights derived from the number of plants in each group in 1972. It was assumed the proportion of plants in each group did not change significantly for 1973. The national total can be obtained by multiplying average per plant data by the total number of plants in 1973.

The third form reported information on the total industry by region and plant size which was inferred from the sample results. This was based on weights derived from the proportion of cheese production in that group.

Table B.1--Total cheese manufacturing plants in 1972

Region	Plant size			
	Small	Medium	Large	Total
Region 1	300	113	15	428
Region 2	40	66	19	125
Region 3	226	103	19	348
Total U.S.	566	282	53	901

Table B.2--Plants in sample

Region	Plant size							
	Small		Medium		Large		Total	
	American:	Total	American:	Total	American:	Total	American:	Total
	cheese	cheese	cheese	cheese	cheese	cheese	cheese	cheese
Region 1	29	37	25	42	9	13	63	92
Region 2	11	11	17	20	15	21	43	52
Region 3	19	30	18	34	7	17	44	81
Total U.S.	59	78	60	96	31	51	150	225

APPENDIX C--QUESTIONNAIRE ON STRUCTURE AND ORGANIZATION OF CHEESE PLANTS

(ALL QUESTIONS REFER TO 1973.)

SECTION I. GENERAL PLANT DESCRIPTION

1. What is the structure of the work force at this plant (average number of workers in 1973)?

a. Managerial and supervisory personnel Number _____

b. Production personnel:

(1) Skilled (Specify _____)..... Number _____

(Specify _____)..... Number _____

(Specify _____)..... Number _____

(2) Maintenance and support personnel Number _____

c. TOTAL WORK FORCE [a + b(1) + b(2)] Number _____

2. How old is this plant? Years _____

3. What is the type of organization? (Enter Code)

Code

- 1 - Multi-unit corporation
- 2 - Single unit corporation
- 3 - Local proprietorship or partnership
- 4 - Regional proprietorship or partnership
- 5 - National proprietorship or partnership
- 6 - Multi-unit cooperative
- 7 - Single unit cooperative

CODE _____

4. Has the plant been remodeled, expanded or had major improvements in the last three years, 1971 - 73?

NO YES - Briefly describe: _____

SECTION II. CHEESE AND CHEESE PRODUCTS

5. How much cheese powder was produced in this plant in 1973? Pounds _____

6. How much dehydrated cheese was produced in this plant in 1973? Pounds _____

SECTION II. CHEESE AND CHEESE PRODUCTS (Cont.)

7. Of the **American Natural cheese** produced in 1973 in this plant, what percent of the total production was in each of the following forms or styles? (Include Cheddar, Colby, stirred curd, washed curd, Monterey and Jack.)

a. Longhorn.....	_____	%
b. Daisy.....	_____	%
c. Midget.....	_____	%
d. Cheddar.....	_____	%
e. 40 pound block.....	_____	%
f. 60 pound block.....	_____	%
g. 500 pound barrel.....	_____	%
h. 640 pound block.....	_____	%
i. Other (Specify) _____	_____	%
_____	_____	%
_____	_____	%
Total		100%

8. Of the **other than American cheese** produced in 1973 in this plant, what percent was of the following major varieties and styles?

a. Rindless Swiss.....	_____	%
b. Wheel Swiss.....	_____	%
c. Block Mozzarella.....	_____	%
d. Blue.....	_____	%
e. Other (Specify) _____	_____	%
_____	_____	%
_____	_____	%
Total		100%

9. Had you considered manufacturing **other varieties** of cheese in the last three years?

NO **YES** - What varieties? _____

a. Reasons for not manufacturing other varieties. (Money, equipment, location, milk supply, market, etc.)

SECTION II. CHEESE AND CHEESE PRODUCTS (Cont.)

10. What **disposition** was made of the **liquid whey** produced in this plant in 1973? (Percent of total)

a. Sold for further processing.....	_____	%
b. Condensed	_____	%
c. Dried.....	_____	%
d. Modified	_____	%
e. Dumped in:		
(1) Municipal sewer.....	_____	%
(2) Private sewage treatment plant.....	_____	%
(3) Lagoon.....	_____	%
(4) Irrigation systems	_____	%
f. Other (Specify _____)	_____	%
	Total	100%

11. What percent of the total 1973 **cheese production** of this plant was produced in each of the following seasons?

a. Spring (March, April and May).....	_____	%
b. Summer (June, July, August).....	_____	%
c. Fall (September, October, November).....	_____	%
d. Winter (December, January and February).....	_____	%
	Total	100%

12. What percent of the **average weekly production** in 1973, was produced each day during the flush season and short season?

	Flush	Short
a. Monday	%	%
b. Tuesday	%	%
c. Wednesday	%	%
d. Thursday.....	%	%
e. Friday.....	%	%
f. Saturday	%	%
g. Sunday.....	%	%
	Total	
	100%	100%

SECTION II. CHEESE AND CHEESE PRODUCTS (Cont.)

13. If production varied within the week, how did the plant get it's **production flexibility**? (Enter Code(s))

Code

- 1 - Storage tanks
- 2 - Hours of production
- 3 - Production shifts
- 4 - Other (Specify _____)

CODE _____

SECTION III. EQUIPMENT AND TECHNOLOGY

14. How many **cheese vats** and/or **curd tables** did this plant have in December 1973? **Number** _____

a. What was the **weekly average** and **peak number** of cheese vats and/or curd tables **used** in December 1973?.....

{	Average _____
	Peak.. _____

15. What was the **volume** of each cheese vat and/or curd table?

- a. Number 1 **Pounds** _____
- b. Number 2 **Pounds** _____
- c. Number 3 **Pounds** _____
- d. Number 4 **Pounds** _____
- e. Number 5 **Pounds** _____
- f. Number 6 **Pounds** _____
- g. Number 7 **Pounds** _____
- h. Number 8 **Pounds** _____
- i. Number 9 **Pounds** _____

16. What was the type of **cheddar cheese production technology** used in 1973? (Enter Code)

Code

- 1 - Standard vat with manual hooping
- 2 - Standard vat with automatic weighing and hooping
- 3 - Standard vat with automatic milling, salting, weighing and hooping
- 4 - Two-tier with manual hooping
- 5 - Two-tier with automatic weighing and hooping
- 6 - Two-tier with automatic milling, salting, weighing and hooping
- 7 - Automatic cheddaring
- 8 - Automatic cooking
- 9 - Automatic cooking and cheddaring

CODE _____

17. What is the **cheese storage capacity** at this plant?..... **Pounds** _____

SECTION III. EQUIPMENT AND TECHNOLOGY (Cont.)

18. What is the **average number of days** each of the following types of cheese is **stored at the plant** or at a plant leased cooler before it is marketed?
- a. Cheddar Days _____
 - b. Colby Days _____
 - c. Swiss Days _____
 - d. Italian..... Days _____
 - e. Other (Specify) _____ Days _____
 _____ Days _____
 _____ Days _____
19. What percent of the **cheese** is **graded** at your plant?..... %

SECTION IV. MILK AND MILK STANDARDIZATION

20. What percent of the **total milk bought** for cheese in 1973 was from each of the following sources?
- a. Individual producers, bulk..... %
 - b. Individual producers, can %
 - c. Directly from producer cooperatives %
 - d. Other plants or receiving stations %
 - e. Other (Specify) _____ %
 _____ %
 _____ %
- Total 100%**
21. If **individual producers** supplied part of the milk:
- a. What was the **average number** of these producers in --
 - (1) June 1973? **Number** _____
 - (2) November 1973?..... **Number** _____
 - b. How far were these **producers** from the plant?
 - (1) Farthest **Miles** _____
 - (2) Closest..... **Miles** _____
 - (3) Average..... **Miles** _____
22. What percent of the **total milk supply** used for cheese manufacture in 1973 was **GRADE A**?..... %

SECTION IV. MILK AND MILK STANDARDIZATION (Cont.)

23. What is the total milk storage capacity at the plant? Gallons _____
24. Do you standardize milk received? YES NO
- a. If YES, give milkfat content of standardized milk used to manufacture--
- | | | | |
|---------------------------------|---------|-------|---|
| (1) American natural types..... | Milkfat | _____ | % |
| (2) Swiss..... | Milkfat | _____ | % |
| (3) Italian, Mozzarella | Milkfat | _____ | % |
| (4) Other Italian types | Milkfat | _____ | % |
| (5) Other varieties..... | Milkfat | _____ | % |

SECTION V. DISPOSITION

25. What percent of the plant's cheese production in 1973 was sold to each of the following buyers?
- | | | |
|--|--------------|-------------|
| a. Assembler | _____ | % |
| b. Retail food chain | _____ | % |
| c. National cheese company | _____ | % |
| d. Wholesaler..... | _____ | % |
| e. Marketing cooperative | _____ | % |
| f. Broker..... | _____ | % |
| g. Government, under price support or related programs | _____ | % |
| h. Food company outside the dairy industry..... | _____ | % |
| i. Retail sales by plant..... | _____ | % |
| j. Other (Specify) _____ | _____ | % |
| _____ | _____ | % |
| | Total | 100% |

26. What percent of the total cheese production in 1973 was transported from this plant to the first buyer by:
- | | | |
|-----------------|-------|---|
| a. Truck? | _____ | % |
| b. Rail?..... | _____ | % |

SECTION V. DISPOSITION (Cont.)

27. If cheese was transported by trucks, who owns them? (Enter Code)

Code

- 1 - This plant or associated with this firm
- 2 - Buyer
- 3 - Independent trucking company
- 4 - Other (Specify _____)

CODE _____

28. How far was the cheese transported to the first buyer in 1973?

a. Farthest distanceMiles _____

b. Average distanceMiles _____

29. What is the pickup interval at the plant for cheese?
(Report percent of total movement.)

a. Each day%

b. Every other day.....%

c. Twice a week%

d. Once a week%

e. Once a month.....%

f. Other (Specify _____).....%

Total **100%**

Thank you.

Please check here if you would like to receive a report of the results of this survey.