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Table 2.5.   Estimate of Cheese Usage by Channel, 1993 (in millions of pounds, natural equivalents)

	1993 Estimated Usage (MM lbs)	Share of Total Cheese	% Share by Channel		
			Retail	Foodservice	Food Processing
Group A					
Cheddar	5,945	87%	36-40%	42-47%	16-18%
Mozzarella	2,363	35%	42-50%	32-38%	17-19%
Cream	1,983	29%	14-16%	66-70%	16-18%
Swiss	540	8%	50-58%	16-18%	28-30%
Ricotta	309	5%	42-52%	38-46%	10-12%
Provolone	234	3%	49-55%	22-30%	21-23%
Parmesan	177	3%	36-42%	56-62%	1-3%
Muenster	130	2%	54-58%	20-27%	19-22%
Blue	123	2%	57-61%	36-46%	Min
Romano	39	11%	15-25%	52-62%	20-26%
Brick	34	1%	24-36%	35-47%	26-32%
	13	0%	77-92%	8-23%	Min
Group B	810-830	12%	61-65%	34-38%	1-2%
Group C	30-40	1%	91-94%	3-12%	Min
TOTAL	6,800	100%	40%	44%	16%

Note: Bakers cheese is included with cream cheese.
Sources: Wisconsin Milk Marketing Board estimate based upon *Dairy Products Annual*, USDA and Technomic, Inc.; percent share by channel based upon manufacturer input and secondary data sources.

Public Report

Market Share and Concentration Figures

The Bureau of Census is the most widely used source of industry concentration figures for U.S. food manufacturing industries. However, these figures are available only every five years with substantial delays, and frequently have other limitations for studying competition. Census figures do have the advantage of providing a time series estimated with a fairly consistent methodology over time. Census defines the following four cheese product classes:

Census cheese product classes:	Value of Shipments	
SIC	1987	1992
20223 Natural cheese, except cottage cheese	$6,414.5	$9906.9
20224 Process cheese and related product	3,502.0	5016.1
20225 Cheese substitutes	294.9	313.9
20220 Cheese, natural and processed, n.s.k. (not specified by kind)	564.3	438.8

For our purposes, SIC 20223 and 20224 are of primary interest. The product class four-firm concentration ratios for 1972-1987 were as follows:

	Natural Cheese (SIC 20223)	Processed Cheese (SIC 20224)	Natural & Processed (4 Prod. Classes Comb.)
1972	36%	60%	40%
1977	32	59	38
1982	32	64	35
1987	35	71	41

Concentration figures from the 1992 Census of Manufactures are available at the 4 digit level only (SIC 2022). The four largest cheese manufacturers and processors accounted for 42 percent of industry value of shipments. By comparison, the 4 digit four-firm concentration figure in 1987 was 43 and in 1982 was 34.

Based upon the above figures, concentration in natural cheese manufacturing is low and shows no clear trend; concentration in cheese processing is high and increasing. The most relevant concentration measure is for all natural and processed cheese combined; here concentration declined from 1972 to 1982, increased sharply between 1982 and 1987, and reached a plateau from 1987 to 1992.

An alternative source of data is NASS, the National Agricultural Statistics Service of the USDA. NASS routinely collects data from cheese manufacturing and cheese processing plants on the *pounds* of various types of cheese produced. NASS does not collect value of shipment data, however. Nor does it estimate market shares based upon tonnage data. Census data on value of shipments are more reliable than its data on tonnage, part of which is imputed. When NASS and Census tonnage figures are compared, there are significant differences (see Appendix 2a). We believe NASS tonnage figures are more accurate than those from Census and rely on NASS figures in our estimates of quantity market shares.

As part of this study, we obtained data from 16 of the leading cheese companies on the pounds of cheese manufactured, purchased, processed and sold. The most complete data set is for 1992. Using NASS data as the denominator, we estimate the following *tonnage* share of the market for the four leading firms:

	1992 CR4
Natural Cheese Manufacturing	29%
Processed Cheese Production/Marketing	69
Natural Cheese Marketers	25
Marketers of Processed & Natural Cheese	38

These figures understate the concentration of sales as measured by value since leading cheese marketers with strong brands like Kraft, Sargento and Borden receive higher prices per

pound than firms selling primarily private label brands and cheese for foodservice. It is no surprise that Census concentration figures based on value of shipments are somewhat higher than our figures based on tonnage. Concentration of sales measured in value terms is usually a better indicator of market power than concentration of tonnage.

It would be helpful to have similar market share estimates for the major channels, especially retail and food service/industrial. Unfortunately, no market share data are available for the latter. Market share information for retail cheese sales are available from sources such as SAMI and Info Scan. These data are summarized in the following section.

Retail Cheese Sales

Approximately 40 percent of U.S. cheese is sold through retail outlets, mostly grocery supermarkets. For cheese sales through supermarkets, relatively detailed information on market shares is available from private market research companies. I.R.I. (Information Resources, Inc.) collects scanner data from a sample of supermarkets and projects national market shares (sales and volume shares) based upon their sample. In this section, we provide I.R.I. Infoscan data on retail cheese sales for 1992.[22]

Table 2.6 provides a breakdown of supermarket cheese sales by nine categories. Nearly three-fourths of supermarket cheese sales falls into three categories: American Processed Slices and Loafs, Natural (not shredded) and Natural Shredded.

Table 2.7 provides market share figures for several of the leading cheese companies for

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[22] These data are from Andrew W. Franklin and Ronald W. Cotterill, Pricing and Market Strategies in the National Branded Cheese Industry, Food Marketing Policy Center, Research Report No. 26, September 1994, University of Connecticut, Department of Agricultural and Resource Economics.

Table 2.6 Supermarket Sales by Type of Cheese, U.S., 1992

	Dollar Sales (Million $)	$ Share (Percent)	Volume (Million lbs.)	Volume Share (Percent)
Processed Cheese & Cheese Food:				
American Processed Slices & Loafs	$1563.1	29.1%	568.40	31.7%
Spreads and Balls	415.2	7.7	125.35	7.0
Natural Cheese:				
Natural (not shredded)	1497.0	27.9	431.24	24.1
Natural Shredded	829.1	15.5	227.41	12.7
Cream Cheese	598.0	11.1	254.17	14.2
Ricotta	161.0	3.0	93.65	5.2
All Other:	300.1	5.6	90.87	5.1
TOTAL	$5363.5	99.9%	1791.09	100.0%

Source: I.R.I. Infoscan data, Franklin and Cotterill, *op. cit.*, Food Marketing Policy Center, University of Connecticut.

Table 2.7. Dollar Market Shares of Leading Cheese Brands and Companies, U.S. Supermarket Cheese Sales, 1992

Type of Cheese	Kraft	ConAgra (Beatrice)	Sargento	Sorrento	Borden	RJR	Land O' Lakes	Fromageries	Other Brands	Private Label
Amer. Proc. Slices/Loafs	59.4%				8.0%		1.1%		8.1%	23.4%
Spreads/Balls	45.2					12.9%		10.8	17.8	13.3
Natural (not shredded)	30.7	2.5%		4.2%			2.0		31.1	29.5
Natural Shredded	25.4	2.2	26.0%	3.6			0.9		7.0	34.9
Cream Cheese	68.0								9.7	22.3

Source: I.R.I. Infoscan data, Franklin and Cotterill, *op. cit.*, Food Marketing Policy Center, University of Connecticut.

five categories of cheese. Companies are credited only with brand sales that can be traced to that company. Thus, sales of the County Line brand are credited to ConAgra, which owns Beatrice Cheese, Inc. Private label cheese supplied by ConAgra is not identified by these data, however. Thus, the market shares in this table understate these companies' actual shares.

Kraft is the leading brand marketer in four of the five categories--usually by a wide margin. Only in Natural Shredded cheese does Kraft yield first place to Sargento. Otherwise, Kraft is clearly the dominant brand.

Private label cheese sales account for shares ranging from 13 percent of Spreads and Balls to 35 percent of Natural Shredded. Since private label brands are undifferentiated products and several companies compete to supply private label cheese to supermarkets, we expect private label cheese to be priced more competitively than branded cheeses, which often carry a substantial price premium. For example, in 1992 the average retail price for Kraft's Philadelphia Cream Cheese brand was $2.46 per pound, while that of private label cream cheese was $1.73 per pound, a 42 percent difference. In natural shredded cheese, the retail price of Sargento brand averaged $4.40 per pound, compared to $3.07 per pound for private label, constituting a 43 percent premium for Sargento. It is important to recognize that some difference in quality and packaging may account for at least some of these price differences. In addition, these are retail price differences, not the prices realized by cheese converters/marketers. However, other data obtained from the leading cheese marketers indicates that most of the retail price differences reflect disparities in the prices and margins realized by cheese marketers. Leading brands do realize huge premiums over similar private labels.

Vertical Linkages in Cheese Subsector

As shown in previous sections, there is considerable vertical integration of the stages shown in Figure 2.11. Most of the leading manufacturers of natural cheese are also large converters and marketers of cheese. A few of the leading converters-marketers do little if any cheese manufacturing (Schreiber, Borden, Sargento). Among firms smaller than those listed in Tables 2.2, 2.3, and 2.4, there is less vertical integration and more specialization, except for small specialty cheese companies that are totally integrated from manufacturing to distribution.

Although Associated Milk Producers, Inc. (AMPI), Land O' Lakes (LOL) and Mid-America Dairymen, Inc. (Mid-Am)--the three largest dairy cooperatives--perform some conversion and marketing of cheese, they are all major sellers of bulk cheese. Sales of bulk cheese are almost always formula-priced off the NCE. Based upon what we learned in our interviews with cheese companies, roughly 5 to 10 percent of bulk cheese is sold on an uncommitted, negotiated price basis; 90 to 95 percent is sold on a committed basis (oral or written contract) in which the cheese is formula-priced. In some instances, cheese prices are formula-priced based upon the M-W or BFP milk price. These arrangements tend to be with large retail, foodservice or industrial customers and reflect cost-based rather than value-based formulas. Cost-based formulas, however, represent only a small portion of the 90 to 95 percent of bulk cheese sold on a committed basis. The vast majority of the formulas are tied to prices established on the National Cheese Exchange, where less than 0.5 percent of total cheese manufactured was sold during 1988-1993.

Some types of cheese have not historically been formula-priced. This is true for cream, Romano and Parmesan, all of which are sold on list prices. This may be because the Kraft brand

dominates these cheese products and likely provides a price umbrella for private label and lesser known brands.

Most cheese marketers do most of the cheese conversion themselves and sell finished products to retail, food service or industrial accounts. Branded processed and natural cheese sold to retail accounts is generally sold on a list-price basis. Private label cheeses sold to retail accounts and all cheese sold to food service and industrial accounts tend to be "priced off" the NCE.

H. Characteristics of Major Firms in Cheese Subsector

Of the major firms listed on Tables 2.2, 2.3, and 2.4, all handled at least 100 million pounds of cheese in 1992. Some of these firms are primarily manufacturers of cheese, others are primarily converters/marketers, and a few are integrated manufacturers-converters-marketers. We classify the firms as follows:

1) Primarily Manufacturers of Cheese: Sell mostly bulk cheese; manufacture nearly all cheese sold.

- Associated Milk Producers, Inc. (AMPI)
- Wisconsin Dairies (now Foremost Dairies)

2) Primarily Converters-Marketers: Buy nearly all bulk cheese used

- Borden, Inc.
- Sargento Foods, Inc.
- Schreiber Foods, Inc.

3) Integrated Manufacturer-Converter-Marketer: Manufacture at least one-third of cheese marketed; convert and market a significant portion of all cheese sold.

- Beatrice Cheese, Inc. (owned by ConAgra, Inc.)

- Kraft General Foods, Inc. (owned by Philip Morris Companies, Inc.)

- Land O' Lakes, Inc.

- Mid-America Dairymen, Inc.

The economic fortunes of all these companies are significantly influenced by NCE prices. Just how that influence occurs depends upon the company's business, and particularly on the extent to which their buying prices and their selling prices are tied to the NCE price. We will examine this in more depth in Chapter 4.

Role of Cooperatives

Agricultural cooperatives have been important factors in dairy marketing for decades. In 1992, cooperatives handled over 80 percent of all milk produced by farmers in the U.S. The Agricultural Cooperative Service (ACS) estimates that in 1992, cooperatives held the following shares of dairy product manufacturing:[23]

Butter production--65 percent

Dry milk products--81 percent

Natural cheese production--43 percent

Pkg fluid milk products--16 percent

Ice cream--10 percent

Cottage cheese--13 percent

Data submitted by 10 large cooperatives as part of this study indicates that 10

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[23] Charles K. Ling and Carolyn B. Liebrand, "Marketing Operations of Dairy Cooperatives," USDA, ACS Res. Rept. 133, April 1994.

cooperatives accounted for about 33 percent of natural cheese manufactured in 1992. ACS estimated the top 11 cooperatives accounted for 38 percent of cheese sales in 1992; however, 3 percent of this was processed cheese sales.

Whereas ACS estimated that cooperatives accounted for 43 percent of all natural cheese production in 1992, Kraft estimated that cooperatives manufactured 65 percent of all cheese in 1988. [24] We do not know the reason for this large difference.

Cooperatives are more important at the manufacturing stage than at the converting stage. Associated Milk Producers, Inc. (AMPI), Mid-America Dairymen, Inc. (Mid-Am), Land O' Lakes (LOL), Wisconsin Dairies, Alto Creamery and several smaller cooperatives are major suppliers of bulk cheese to cheese converters/marketers.

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[24]   Kraft General Foods, Inc., *Cheese Procurement Strategy*, Operations, December 6, 1989, KGF 2948, 2975.

Appendix 2.A.
Comparison of NASS and Census Data on Tonnage of Cheese Produced

Cheese quantity figures from Census and NASS are as follows for 1982, 1987 and 1992:

	1982		1987		1992	
	(Millions of Pounds)					
	Census	NASS	Census	NASS	Census	NASS
Natural Cheese Production	3685.2	4541.7 (+857)	4801.6	5344.4 (+542.)	6830.9	6488.3 (-342.6)
Processed Cheese	2030.0	1723.6 (-306)	2563.7	1961.7 (-602)	3364.5	2202.7 (-1161.8)
Natural and Proc. Cheese, n.s.k.	274.6	---	418.0	---	272.3	---
TOTAL	5989.8	6265.3 (+275.5)	7783.3	7306.1 (-477.2)	10467.7	8691.0 -1776.7

In both 1982 and 1987, Census figures for pounds of natural cheese produced were considerably under NASS. For 1992, however, Census pounds of natural cheese produced were 343 million greater than NASS. Census poundage for processed cheese products was greater than NASS in all three years. Since Census has an n.s.k. (not specified by kind) product class and NASS does not, one might expect Census figures for natural and processed cheese production to be somewhat lower than NASS.

Several factors lead us to believe NASS figures are more accurate. Whereas Census relies on a mail questionnaire every five years to collect data, NASS collects data from each plant every month. It would be easy for some natural cheese to be misclassified by Census as processed cheese; some cheese manufacturers refer to barrel cheese headed for processing as "process cheese." This may partly explain the 30 percent increase in processed cheese tonnage

from 1987 to 1992 shown by Census compared to a more plausible 12 percent increase shown by

NASS.

Another source of error is the way natural cheese "cut and wrap" operations are handled.

NASS collects no data from these operations. Census includes the data from these operations as

part of 20223--natural cheese manufacturing. In the rare case in which cut and wrap operations

are in the same plant that manufactures bulk cheese, there would be no double counting. In the

typical case in which cut and wrap operations are in separate plants, Census procedures would

result in double counting of natural cheese tonnage. This may explain, at least for 1992, the

substantially higher tonnage reported by Census for all categories. For natural and processed

cheese combined, Census quantity figures are 20 percent greater than NASS in 1992. We

believe the NASS figures are much more reasonable than Census.

Appendix Table 2.1. Cheese Imports and Exports as Percent of Total Cheese Production, 1980-1995

Year	Imports			Exports			Total U.S. Production	Percent of Total U.S. Production	
	American	Other	Total	American	Other	Total		Imports	Exports
	(Million Pounds)							Percent	
1980	18	213	231	5	8	13	3984.266	5.80	0.33
1981	20	228	248	19	8	27	4277.561	5.80	0.63
1982	18	251	269	37	26	63	4541.669	5.92	1.39
1983	22	265	287	42	10	52	4819.471	5.96	1.08
1984	24	282	306	59	8	67	4673.993	6.55	1.43
1985	20	283	303	70	16	86	5080.942	5.96	1.69
1986	23	272	295	49	8	57	5209.252	5.66	1.09
1987	15	250	265	35	8	43	5344.364	4.96	0.80
1988	18	234	252	25	9	34	5571.973	4.52	0.61
1989	20	256	276	6	15	21	5615.372	4.92	0.37
1990	21	277	298	6	20	26	6059.436	4.91	0.45
1991	21	276	297	10	17	27	6054.855	4.91	0.43
1992	18	267	285	16	24	40	6488.291	4.39	0.49
1993	20	300	320	8	33	41	6528.172	4.92	0.63
1994	17	315	332	11	44	55	6730.000	4.93	0.82
1995[1]	20	317	337	26	46	72	6914.000	4.87	1.04

Source: Dairy Situation and Outlook Yearbooks, ERS, USDA
[1] 1995 figures are preliminary.

Appendix Table 2.2. Total Cheese Production by State: 1940, 1950, 1960, 1980 and 1994

(Thousand pounds)

State	1940	1950	1960	1970	1980	1994
CA	16019	10136	18259	17460	181463	926283
ID	13256	20895	36733	58141	109351	264602
IL	47805	80556	78505	86186	98500	102246
IA	4024	11312	42885	103516	204577	268828
MN	16272	52329	72569	161539	512361	658036
MO	19677	63767	93591	98562	100796	198540
NY	59918	87582	118541	158317	319579	559636
OH	21425	45773	37183	43525	95166	102655
OR	21488	24890	20612	NA	34683	45978
PA	11072	12437	11165	24515	101262	348285
SD	982	1664	10748	NA	78836	148484
VT	1945	5109	9770	32730	79836	122872
WI	406903	557951	641119	947591	1484251	2017946
Sub-total	640786	974401	1191680	1732082	3400661	5764391
Total U.S.	785737	1192557	1477920	2203756	3983129	6730067

Percent of Total U.S. Production

State	1940	1950	1960	1970	1980	1994
CA	2.04%	0.85%	1.24%	0.79%	4.56%	13.76%
ID	1.69%	1.75%	2.49%	2.64%	2.75%	3.93%
IL	6.08%	6.75%	5.31%	3.91%	2.47%	1.52%
IA	0.51%	0.95%	2.90%	4.70%	5.14%	3.99%
MN	2.07%	4.39%	4.91%	7.33%	12.86%	9.78%
MO	2.50%	5.35%	6.33%	4.47%	2.53%	2.95%
NY	7.63%	7.34%	8.02%	7.18%	8.02%	8.32%
OH	2.73%	3.84%	2.52%	1.98%	2.39%	1.53%
OR	2.73%	2.09%	1.39%	NA	0.87%	0.68%
PA	1.41%	1.04%	0.76%	1.11%	2.54%	5.18%
SD	0.12%	0.14%	0.73%	NA	1.98%	2.21%
VT	0.25%	0.43%	0.66%	1.49%	2.00%	1.83%
WI	51.79%	46.79%	43.38%	43.00%	37.26%	29.98%
Sub-total	81.55%	81.71%	80.63%	78.60%	85.38%	85.65%
Total U.S.	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Source: National Agricultural Statistical Service, *Dairy Products Annual*, various years.
Note: NA indicates no figure was reported for that state by NASS.

Chapter 3--Origins and Nature of the National Cheese Exchange

This chapter provides a brief history of the Exchange, describes salient features of its current organization, identifies the regulatory authorities with jurisdiction over the Exchange, reviews the potential problems of thinly traded markets, and examines certain unique characteristics of the Exchange, especially the small volume of cheese traded and the concentration of trading activity among a few traders.

A. History of NCE

The nation's first cheese factory was started by five Wisconsin farmers in 1841.[1] In succeeding decades numerous cheese factories were established, especially in New York and Wisconsin. The Census Bureau reported that in 1870 there were 1,313 cheese factories in the United States. Only 54 (4.1 percent) of these were located in Wisconsin (Appendix Table 3.2). Fully 62 percent of all U.S. cheese plants were located in New York and another 15 percent in Ohio. The number of cheese factories grew in succeeding decades, reaching a peak around the turn of the century. In 1920 the Census Bureau reported 3,530 factories in the U.S. with 2,323 (64 percent) located in Wisconsin; these plants made 65 percent of all cheese in the U.S. In contrast, New York and Ohio had only 17 percent of all cheese plants and 19 percent of all cheese production. Thereafter the number of plants in the U.S. declined steadily until there were only 418 cheese companies in the nation by 1992, and only 216 companies had annual sales over $100,000 in 1987 (Appendix Table 3.1).

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[1] For the number of cheese factories and companies over time, see Appendix Tables 3.1 and 3.2.

Initially, cheese was bought directly from factories by dealers who assembled cheese from several factories. Subsequently, cheese factories established dairy boards that served as meeting places for factory representatives and cheese buyers. By 1879 there were seven dairy boards in Wisconsin.[2] Dairy boards also operated in New York and other states.

To encourage competitive bidding among dealers a Call Board system developed whereby offers from cheese factories and bids from interested buyers were recorded on a blackboard, with sales going to the highest bidder. By 1890 there were 18 Call Boards in Wisconsin.[3]

The Boards typically served quite small regions, often individual counties. In 1909 the Dairy Board located in Plymouth, Wisconsin, changed its rules to permit any factory in Wisconsin to sell on the board, an important step in making it the largest board in the state. In 1913 it was renamed the Plymouth Central Call Board of Trade. At the time there were six other call boards in the state. In 1918 the Central Call Board of Trade was reorganized to give full membership only to dealers and was incorporated as the Wisconsin Cheese Exchange.[4]

In response to producer dissatisfaction with the Exchange, the Farmer's Call Board was established in Plymouth in 1921. Cheese factories and cheese producer associations could become members, but only dealers were given buying privileges. The Farmer's Call Board,

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[2] Henry C. Taylor, W.A. Schoenfeld, and G.S. Wehrwein, *The Marketing of Wisconsin Cheese*, Bulletin No. 231, 1913, p. 12.

[3] *Ibid.*

[4] Arthur H. Miller, *Pricing American Cheese at Wisconsin Factories*, University of Wisconsin-Madison, Res. Bul. 163, August 1949, p. 10.

which met shortly after the weekly sessions of the Wisconsin Cheese Exchange, came under

increasing criticism (see below) and discontinued operations in 1941. That left only the

Wisconsin Cheese Exchange, which in 1956 was moved to Green Bay, Wisconsin, where it

remains at present. In 1974 its name was changed to the National Cheese Exchange (NCE).

Periodic criticisms of the pricing practices of the dairy boards and their successors have

resulted in a number of investigations by state and federal authorities. In 1911 dealers allegedly

fixed prices and allocated customers among themselves at secret meetings held prior to call

board sessions.[5] Cheese producers responded to the situation in 1913 by organizing the

Sheboygan County Cheese Producers' Federation. Farmers hoped that by cooperative action

they could develop their own marketing system and ultimately eliminate the Board.[6]

An investigation by the State of Wisconsin during 1931-32 concluded that the Farmers

Call Board was a sham designed to placate farmers' dissatisfaction, but changed nothing. The

Deputy Attorney General of Wisconsin, in summarizing evidence taken before the Wisconsin

Commissioner of Agriculture, drew the following conclusion:

> The dealers and not the farmers conceived the idea of the organization of the board in the
> first place, and certain farmers lent their names then and since. In fact, the Farmers Call
> Board was organized to meet the growing dissatisfaction by producers with prices fixed
> by the dealers between themselves in their own organization, the Plymouth Cheese
> Exchange, and to make it appear that the farmers have set up their own market to which
> the dealers had to go to get cheese. The fraud of the name of the board is aggravated by
> its pretended farmer operation and control and by the insistence of the dealers that it is in
> fact a farmers' organization, and the persistent representation and advertisement of it as
> such.[7]

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[5] Federal Trade Commission, *Cooperative Marketing*, May 2, 1928, p. 10.

[6] *Id.*, pp. 10-11.

[7] *Report of the Federal Trade Commission on the Sale and Distribution of Milk and Milk Products*, Chicago Sales Area, 1936, p. 97.

The Deputy Attorney General went on to say that

> Whether competition really exists in the buying on the board is better judged by the results than the assertions of interested parties. The prices follow quite faithfully the base price fixed between the dealers on their own exchange each week, just an hour earlier.[8]

The fact that the Farmers Call Board followed "faithfully" the prices set by the Wisconsin Cheese Exchange was important because of the way in which Exchange prices were set at the time. The pricing process was explained as follows by Mr. J.L. Kraft, President of the Kraft-Phoenix Cheese Corporation:

> For the past few years a fair price has been established on the Plymouth Call Board in Wisconsin, which, to a very large extent, has been the ruling price throughout the country, or, in other words, the basic price from which to figure. This price has not been established by agreement but rather by sort of a tacit or mutual understanding as to what a fair relationship or fair value for the product should be, based upon statistical information at hand and the law of supply and demand.[9]

These comments reflect a mind set that believed "fair" prices could best be set by "a sort of tacit or mutual understanding" among industry leaders.

Based on its study of cheese pricing on the Wisconsin Cheese Exchange and Farmers' Call Board, the Federal Trade Commission concluded, in part:

> ...[T]he transactions on these boards are relatively small and seemingly without any real competition....[T]he real purpose of these boards appears to be to establish the price to be paid by dealers during the ensuing week, such action being taken under a prearranged program....[T]he absence of competition upon [the Wisconsin Cheese Exchange] has a significant influence upon the prices received by milk producers.[10]

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[8]   *Id.*

[9]   *Id.*, pp. 98-99.

[10]   *Report of the Federal Trade Commission on Agricultural Income Inquiry, Part 1, Principal Farm Products*, 1938, p. 46.

In 1939, Professor William H. Nicholls, the leading economic authority of that day on competitive conduct in agricultural markets, including the cheese market, observed:

> The real point at hand is the fact that only the buyer of cheese--the large-scale distributor--is party to the decision as to what the "fair" price should be. The "law of supply and demand" is doubtless important in the decision of the large cheese distributors as to the "fair" price of cheese, but there seems to be *prima facia* reason to raise the question whether that famous economic law as interpreted by those distributors is the most desirable from the social viewpoint, either for the milk producer or the consumer.[11]

Nicholls concluded as follows concerning the state of competition in cheese pricing as of 1939:

> Bulk cheese prices continue to be established on the two Plymouth exchanges, in spite of repeated recognition of the obvious lack of competition on the boards....
>
> The chief competition the cheese industry has to meet is not within the industry itself. This competition is with the butter and condensed milk industries for the use of the milk supply. This competition still leaves a significant range within which monopolistic elements in the cheese industry can work against the farmer who sells his milk to the cross-roads cheese factory.[12]

Following its extensive investigations of cheese pricing during the 1930s, the Wisconsin Department of Agriculture brought these matters to the attention of the federal Antitrust Division and assisted it during 1940-1942 in the investigation and prosecution of alleged price fixing of cheese prices paid to producers.[13] These cases charged price fixing of Swiss, American, and brick cheese.[14] The actions culminated in a consent decree and $30,000 fine in the Swiss case

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[11] William H. Nicholls, *Post-War Developments in the Marketing of Cheese*, Iowa State College, Research Bulletin 261, June 1939, p. 106.

[12] Nicholls, *op. cit.*, pp. 118-119.

[13] Ralph J. Geffen, "Antitrust Law in Wisconsin," *Wisconsin Law Review*, July 1951, p. 681.

[14] *United States v. Kraft Cheese Co.*, Criminal Indictment No. 11814, Fed. D.C. of W. Wis. (1940); *United States v. Wis. Cheese Exchange*, Criminal Indictment No. 33198, Fed.

and acquittal in the brick case.[15] After long delays, the American indictment was dismissed in 1950.[16]

On November 20, 1987, the Assembly of the State of Wisconsin enacted a Resolution requesting an investigation of recent price declines on the National Cheese Exchange and a prosecution if any violation of law were found to have occurred.[17] In response to this resolution, the Wisconsin Attorney General initiated a "preliminary investigation to determine whether there was any evidence of price-fixing or collusion or other violations of law on the NCE."[18] The "preliminary investigation," conducted by one attorney and one investigator over a four-month period, involved interviews with the president of the NCE, examination of NCE trading minutes of the board and other NCE documents, and interviews with personnel of 21 companies represented on the NCE, as well as interviews with other interested parties. No internal documents were subpoenaed.

The investigation yielded no evidence of price fixing. A number of parties interviewed indicated that the price declines in 1987 reflected general conditions of supply and demand. The attorney-investigator concluded:

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D.C. of N. Ill. (1942); *United States v. Nat'l Cheese Institute*, Criminal Indictment No. 33197, Fed. D.C. of N. Ill. (1942).

[15]   *United States v. Wisconsin Cheese Exchange*, reported in The Federal Anti-trust Laws with Summary of Cases Instituted by the United States No. 694 (CCH-1947).

[16]   Geffen, *op. cit.*, p. 681

[17]   The State of Wisconsin, 1987 Assembly Resolution 6, "Relating to an Investigation of the National Cheese Exchange," November 20, 1987.

[18]   Matthew J. Frank, Assistant Attorney General to Kevin J. O'Connor, Assistant Attorney General, Unit Head, Consumer Protection and Antitrust Unit, Office of the Attorney General, April 11, 1988.

In the absence of evidence of price-fixing agreements, and in the presence of reasonable explanations for the price declines because of general market conditions in the industry, the Department of Justice can take no further action at this time.[19]

B. Current Organization of NCE

The National Cheese Exchange articles of incorporation state that the purpose of the Exchange

> ...shall be to provide and maintain an exchange for the purchase and sale of cheese by its members and generally to do any lawful act which may be incident to the promotion of said purpose.

The affairs of the Exchange are managed by a Board of Directors, consisting of six members elected by NCE members, and the President, who is appointed by the Board.[20]

The By-Laws of the NCE provide that anyone may become a member by satisfying "the members that he or it is suitable to assume responsibilities and privileges of membership." In recent years, there have been 35-40 members, all of whom were cheese manufacturers, converters, marketers, brokers or customers. Members represent about 90 percent of the cheese industry. Each member may designate up to five persons as traders who can negotiate on the Exchange. The Board may suspend a member from the privilege of trading on the Exchange for up to six months for any conduct considered detrimental to the interests or welfare of the Exchange.[21]

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[19]   *Ibid.*

[20]   This and the following are based on the National Cheese Exchange, Inc., Articles of Incorporation, By-Laws, and Rules Regulating Trading, April 6, 1990.

[21]   See Chapter 4, text at notes 96-109, for an example of suspension for alleged misconduct in trading.

The NCE typically trades each Friday from 10:00 a.m. to 10:30 a.m., but the trading time may be extended if the presiding officer (the president or his designee) observes a continuing interest in trading. Only cheddar cheese in 40-pound blocks and 500-pound barrels in 38,000-42,000 pound carlots was traded until 1994, when 640-pound blocks were added for trade. All bids and offers for these types of cheese are subject to price adjustments for moisture content as provided by the rules. Unless a bid or offer specifies otherwise, the styles traded shall not be less than four days or more than one month of age on the date of sale. Traders may specify older cheese by stating the actual age in terms of months.

Barrel cheese shall meet the requirements of Wisconsin State Brand or USDA Extra Grade or better, and 40-pound block cheese shall meet the requirements of Wisconsin State Brand, USDA Grade A or better, except that moisture content shall be no less than 36.5 percent. Barrel cheese shall be white and block cheese shall be colored. Block style cheese shall be wrapped in a sealed film and packed in corrugated or solid fiberboard containers. Barrels shall be in airtight, 55-gallon steel containers or barrels which meet specifications.

No bids or offers shall disclose the state of origin, but the identity of traders making bids and offers is known. Parties represented by brokers are not disclosed. Bids and offers are stated in multiples of one-fourth of a cent per pound. When a member has an offer on the board, he cannot bid for the same kind of cheese at the same price; while he has an unsatisfied bid on board, he cannot offer the same kind of cheese at the same price.

Transactions on the NCE are FOB Green Bay, but no freight charge is made on cheese within 200 miles of Green Bay. Cheese that is located more than 200 miles from Green Bay has the freight cost to Green Bay (as specified by Exchange rules) deducted from the selling price.

Thus, all cheese is priced as though it is physically shipped to Green Bay. In reality, cheese sold on the NCE can be shipped anywhere within the continental U.S. On those transactions in which the actual freight from seller to buyer is less than the freight from seller's dock to Green Bay, buyers on the Exchange can benefit from the phantom freight charged to sellers.

C. Regulation of the NCE

Several government agencies have authority over trading activity on the National Cheese Exchange. The United States Department of Justice enforces the Sherman Act, which prohibits price fixing agreements and monopolizing conduct. The Federal Trade Commission, which enforces the Federal Trade Commission Act, can act in cases dealing with unfair methods of competition, which include price fixing agreements and monopolizing conduct. The Wisconsin Department of Justice can challenge price fixing agreements and monopolizing conduct under state or federal laws. The Wisconsin Department of Agriculture, Trade and Consumer Protection has jurisdiction over unfair competition and trade practices. Private parties may also initiate actions under the Sherman Act. The law allows a party injured by a violation of the Sherman Act to sue in Federal Court and recover treble damages plus the costs of the suit, including reasonable attorney's fees.

The NCE also became subject to the regulatory authority of the Commodity Futures Trading Commission (CFTC) in 1994 when the Commission designated the Coffee, Sugar, and Cocoa Exchange as a contract market for futures trading on cheddar cheese. The Commodity Exchange Act (CEA) gives the CFTC jurisdiction over commodity futures and options transactions. The CEA also gives the CFTC jurisdiction over the cash markets with futures contract markets. Section 6(c) of the CEA authorizes the CFTC to bring administrative action

against persons believed to be manipulating or attempting to manipulate the price of any

commodity or for future delivery. Section 8 of the CEA gives the CFTC broad power to

investigate the cash market in implementing and enforcing its authority. In *The Matter of Hunt*

et al[22] the CFTC charged persons with manipulating cash prices in addition to futures prices.

D. The NCE is a Thin Market

The term *thin market* as used herein, refers to a market with a small volume of trading

relative to the total transactions that are priced off the market.[23] As such, the term is purely

descriptive, implying nothing regarding a market's pricing or operational efficiency.

Economic examination of thin markets raises two questions: (1) Why is the market thin?

and (2) How well does the market perform? Causes of thin trading are easier to identify than the

results. Thin centralized cash markets in many food industries have common economic roots:

Industry members bypass centralized cash markets because trading there is more costly than

trading directly via either spot purchases or long-term contractual arrangements. This situation

has been true in cheese procurement for over 100 years. The "dairy boards" set up in the 1870s

provided places for buyers and sellers to meet. But apparently after sellers and buyers had met

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22 *In the Matter of Hunt, et al.,* [1987-1990 Transfer Binder] Comm. Fut. L. Rep. (CCH ¶ 24.569 (CFTC Dec. 20, 1989)).

23 This is the definition used by Raikes: "A market is thin if the reservation supply and demand values of only a small proportion of all traders are represented in the market." Ronald Raikes, "Thin Markets: Some Causes, Consequences, and Remedies," in Marvin L. Hayenga (ed.), *Pricing Problems in the Food Industry (With Emphasis on Thin Markets)*." NC Project 117, Monograph 7, Research Division, College of Agriculture and Life Sciences, University of Wisconsin, February 1979, p. 132. Dunn also uses this definition. Read J. Dunn, Jr., "Pricing Problems in the Food Industry: Research Needs," in Hayenga, *op. cit.*, p. 149. Others have defined a thin market as a market "with few transactions negotiated per time period." Hayenga, et. al., in Hayenga, (ed.), *op. cit.*, p. 11.

and developed mutually agreeable arrangements, both parties often preferred trading directly with one another using longer-term formal or informal arrangements. From the outset very little cheese was actually traded on any of the various centralized exchanges that predated the NCE.

Based on industry interviews, we believe that in recent years 90-95 percent of all bulk cheese transactions involve direct procurement using written or verbal committed supply arrangements, often one year in duration; another 5-10 percent involve direct spot transactions; and less than 0.5 percent of all transactions take place on the NCE. But despite the minuscule volume traded on the NCE, virtually all "committed" or contract transactions of bulk cheese use formula agreements that tie the price directly to prices developed on the NCE. Spot transactions also use the NCE as a reference price but have much greater flexibility to change the differential. For example, when NCE prices are declining, buyers may be unwilling to pay any premium over the NCE. Indeed, a negative differential does occasionally occur. The opposite is true when NCE prices are rising.

Formula pricing is heavily used in the cheese subsector, as it is in many other agricultural commodities. Formula pricing is trading on someone else's price; the price for a transaction is determined by an agreed upon formula tied to one or more indicators of value. Formula pricing arrangements that use a thin market price as the indicator of value are of particular interest since the combination gives enormous leverage to the thin market. In the case of cheese, if a firm can influence the price in a market (i.e., the NCE) that operates 30 minutes per week and trades less than one-half of 1 percent of all cheese, that firm has influenced the price of nearly all bulk cheese sold in the U.S. the following week.

Formula pricing and thin markets often go together. As firms adopt formula pricing to reduce transaction costs and price risks, the residual spot market declines in volume. Schrader and colleagues note the consequences:[24]

> The market, thinned by formula-priced transactions that are not immediately responsive to spot market prices, may be less likely to arrive at a price that approximates a competitive equilibrium. Furthermore, firms with formula-priced contracts based on a thin market price may have an incentive to attempt manipulation of the reference price quotation.[25]
>   The combination of a thin market and very few participants on one side of the market may accent price volatility and inequity.[26]

Whenever so much business is transacted with reference to prices established by so few, questions persist concerning the quality of the price discovery process. Economists have identified various dimensions of performance deserving attention in examining thin markets, including the following:

(1) the possible manipulation of thinly-traded markets by dominant firms or concentrated oligopolies, resulting in short or long term monopoly profits and discovered prices that do not accurately reflect industry supply and demand.

(2) possible nonrepresentative or biased price signals, not because of intentional manipulation by participants, but because the buyer demand and seller supply represented in thinly-traded markets does not accurately reflect industry supply and demand. The results are prices that provide inaccurate resource allocation signals to the vertically linked markets in an industry or subsector.

(3) the possible perception of increased risk due to more volatile prices, illiquid markets, and less secure input supply and output markets. Thinly traded markets may be less

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[24] Lee Schrader, et al., "Pricing and Vertical Coordination in the Food System," Chapter 2 in Bruce W. Marion (ed.), *The Organization and Performance of the U.S. Food System*, Lexington Books, 1986.

[25] *Id.*, p. 74.

[26] *Id.*, p. 101.

predictable and may be less able to deal with unexpected shifts in supply or demand than "fat" markets.[27]

Thinly traded markets are thought to be particularly vulnerable to the third problem when most of the supply in the industry moves between firms via contracts or committed arrangements. The logic here is that buyers and sellers are locked into committed supply arrangements in which quantities and prices are largely specified. Shifts in supply or demand, therefore, have an inordinate impact on the residual market. Thinly traded markets are often part of the residual market, which is the case in the cheese industry. The uncommitted supply represents 5-10 percent of total cheese produced; the NCE represents less than one-tenth of that residual market.

Thin trading volume does not necessarily imply poor performance if there is sufficient volume "waiting in the wings" and if no firm is large enough to influence or manipulate price to the firm's advantage.[28] As some analysts have observed, a "thin" market need not perform poorly:

> There may be sufficient volume "waiting in the wings" that could be quickly triggered into the price determination process, suppressing price gyrations or price inequities that otherwise might be "too large." Or, no firm may be large enough in absolute size that relatively small shifts in its inventory or its buy and sell policy could strongly influence or "manipulate" negotiated price levels and the returns from related formula price contracts to the firm's advantage.[29]

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[27]   Marvin L. Hayenga, "Summary" in Hayenga (ed.) *op. cit.*, p. 12.

[28]   *Id.*, pp. 11-12.

[29]   Hayenga, et. al., *op. cit.*, pp. 11-12.

The critical factual question is whether there exists a sufficient supply of potential traders "waiting in the wings" that will be "triggered into the price determination process" to prevent price departures from competitive levels. As Raikes explains,

> [T]here may be no reason to expect that, in general, the reservation values on the demand and supply sides in the central market will be representative of aggregate market demand and supply schedules, or to expect that the price distribution from the residual central market would be the same as the price distribution that would result if suppliers and demanders participated in price determination.[30]

The central market may not be representative of aggregate market conditions for various reasons. Few firms trade in the central market, but virtually all firms use the prices generated there in formula pricing their spot or contract transactions. Even if a non-trading user believes that the central market price is inaccurate, he may continue to use it because the existing alternatives are more costly. As Raikes explains, "Firms legitimately pursue their self interest...by using prices made by other firms to reduce spot transaction costs."[31]

Another reason central markets may not yield competitive results is that some traders enjoy strategic advantages over other traders. For example, if the largest trader(s) is perceived to have superior knowledge of overall supply and demand conditions, other traders and non-traders may be disinclined to challenge its judgment. If these advantages apply to potential as well as actual traders, they prevent the potential traders from contesting price decisions made in the central market.[32]

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[30] Raikes, *op. cit.*, p. 132.

[31] *Id.*

[32] William Baumol, John Panzar and R. Willig, *Contestable Markets and the Theory of Industry Structure*, Harcourt Brace Jovanovich, 1982.

The above conditions imply that there are differences in the competitive market structure of a thin central market and the aggregate market of a product. These differences have special relevance for the NCE where trading is far more concentrated than in other markets or stages of the cheese industry.

The preceding explains why prices in a thin market like the NCE *may* not accurately reflect aggregate market conditions. A related question is whether the price established on the NCE is constrained by the alternative uses for the milk used in making cheese, especially non-fat dry milk and butter. If the milk supply curve facing the bulk cheese manufacturing industry were perfectly elastic and bulk cheese manufacturing were perfectly competitive, the prices for milk and bulk cheese, including the NCE price, would equal competitive levels. In fact, however, bulk cheese producers compete with the manufacturers of butter and non-fat dry milk powder. The upward sloping supply curve for farm-level milk plus the downward sloping derived demand for milk for products other than cheese imply an upward sloping market-equilibrium supply curve for milk to the bulk cheese industry. This, in turn, may provide the opportunity for the exercise of market power in the purchase of bulk cheese. As a result there is a range within which market power may be exercised in setting NCE prices.[33]

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[33]   In his study of cheese pricing, William H. Nicholls concluded that cheese prices could depart from competitive levels:

> The chief competition the cheese industry has to meet is not within the industry itself. This competition is with the butter and condensed milk industries for the use of the milk supply. *This competition still leaves a significant range within which monopolistic elements in the cheese industry can work against the farmer who sells his milk to the cross-roads cheese factory.*

William H. Nicholls, *Post-War Developments in the Marketing of Cheese*, Iowa State College, Research Bulletin 261, June 1939, p. 106. (Emphasis added.)

Those holding a sanguine view of thin markets believe they do not pose significant manipulation problems. Most economists, however, seem to agree with Caves who urges caution in summarily dismissing the likelihood of market manipulation. Market regulators agree. They are interested in thin cash and futures markets "because they are believed to be easily manipulated and susceptible to abusive treatment of customers."[34] Therefore, the Commodity Futures Trading Commission (CFTC) has been assigned authority to prevent manipulation in the cash markets of the commodities which have futures markets regulated by the CFTC.[35]

Although those studying thin markets hold various opinions regarding the quality of their performance, all agree it is not possible to judge performance of particular markets based on economic theory alone. Such a determination requires detailed analysis of the organization and conduct of particular thin markets.[36]

Previous Empirical Studies of Thin Markets

While the consequences of thin markets is largely an empirical question, there are few studies that provide useful insights, partly because of the difficulty of evaluating thin markets. Determining whether price discovery is efficient, whether prices have been manipulated or whether prices are unnecessarily volatile is very difficult. In addition, thin markets often are also concentrated markets in which one or a few buyers or sellers account for most of the trades.

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[34]   Mark J. Powers, former chief economist of the CFTC, "Thin Markets--A Regulatory Perspective," in Hayenga (ed.), *op. cit.*, p. 35.

[35]   Read P. Dunn, Jr., former Commissioner, CFTC, "Pricing Problems in the Food Industry: Research Needs," in Hayenga (ed.), *op. cit.*, p. 149.

[36]   R.E. Caves, "Industrial Organization and the Problem of Thin Markets," in Hayenga (ed.), *op. cit.*, p. 27.

In this situation, it is difficult to separate the effect of market thinness from the effect of market concentration.[37]

Tomek's study of the Denver terminal market for fed cattle is one of the best known studies of thin markets. Tomek found that Denver price movements were increasingly disassociated with price movements in other terminal markets (Omaha and Sioux City) as the volume of cattle on the Denver market declined in the late 1960s.[38] By 1967-68, Denver prices relative to Omaha prices had declined by about 50 cents per cwt. Unfortunately, Tomek never examined whether market power had increased in the Denver market. But, by 1967, only 27,000 head of steers were sold at the Denver market (vs. 165,000 in 1964). The Omaha terminal sold 700,000 head in 1967. As volume declines, the number of buyers also tends to fall. We suspect that the Denver example involved both market thinness (small volume) and buyer market power. The decline in steer prices was likely a consequence of both factors.

Many U.S. agricultural commodities have thin spot or negotiated markets, or have thinly reported markets. This is particularly true in commodities in which formula pricing and/or contracting is widespread. Organized markets, like the NCE, have tended to decline in importance as contracting/formula pricing has increased. Indeed, the NCE is unique as a centralized cash auction market of a manufactured food product. The only similar market with

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[37] A review of empirical studies of auction markets as diverse as bonds, timber, oil drilling rights and construction has found a positive relationship between their performance and the number of effective competitors. R. Preston McAffee and John McMillan, "Auctions and Bidding," 25 *Journal of Economic Literature* (June 1989), 729-731. Lance Brannman, J. Douglas Klein, and Leonard W. Weiss, "The Price Effects of Increased Competition in Auction Markets," *Review of Economics and Statistics*, 1987.

[38] William Tomek, "Price Behavior on a Declining Terminal Market," *Amer. J. of Agric. Econ.*, Aug 1980, p. 434-444.

which we are familiar is the cash butter market located at the Chicago Mercantile Exchange. This market has even less trading than the NCE.[39]

Centralized markets have the virtue of providing low-cost price and quantity information that others can use to reduce their transaction costs. Developing accurate price information from decentralized direct transactions is more costly but may be less vulnerable to the price discovery and manipulation problems of thin central markets. The presence of an effective futures market may improve the price discovery process in thinly traded commodity markets.

The remainder of this chapter examines two features of the NCE that give rise to its characterization as a thin market: the volume of trading and the number and relative size of traders.

Trading Volume on NCE

In all years during 1974-1993, less than 1 percent of total cheese production was sold on the Exchange (Table 3.1). During 1988-1993, cheese traded on the Exchange never exceeded 0.4 percent and averaged 0.2 percent of total cheese manufactured in the U.S. The NCE played an especially important role in cheese pricing during the latter period because government price support programs had less influence on NCE price levels than in many earlier years.

Figure 3.1 depicts barrel prices and total barrel and block sales on the NCE over the course of each year during 1989-1993.[40] Each bar identifies the price at the end of a trading day. When trades occur the number of loads traded are shown near a bar. The wider solid bars

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[39]   See Chapter 4, note 63.

[40]   For clarity of presentation no price line is shown for blocks, which generally move in unison with barrels at a few cents above barrels.

Table 3.1. Volume of Cheese Traded on the NCE, 1974-1993

Year	Carloads Sold on NCE[1]	Total Carloads Manufactured[2] American[3] Cheese	All[4] Cheese	NCE as a Percent of: American Cheese	All Cheese
1974	43	46,558	73,434	0.09%	0.06%
1975	167	41,499	70,285	0.40	0.24
1976	490	51,345	83,006	0.95	0.59
1977	553	51,179	83,963	1.08	0.66
1978	325	51,977	87,992	0.63	0.37
1979	440	54,857	92,931	0.80	0.47
1980	264	59,528	99,607	0.44	0.27
1981	39	66,203	106,939	0.06	0.04
1982	40	68,980	113,542	0.06	0.04
1983	34	73,296	120,487	0.05	0.03
1984	307	66,279	116,850	0.46	0.26
1985	144	71,381	127,024	0.20	0.11
1986	752	69,954	130,231	1.07	0.58
1987	707	67,916	133,609	1.04	0.53
1988	361	68,914	139,299	0.52	0.26
1989	118	66,814	140,384	0.18	0.08
1990	342	72,269	151,486	0.47	0.23
1991	399	69,228	151,371	0.58	0.26
1992	380	73,412	162,207	0.52	0.23
1993	596	73,120	163,204	0.82	0.37

Sources: National Cheese Exchange, Trading Activity Minutes, AMS, USDA, 1974-1993.
Dairy Products Summary, NASS, USDA 1974-1993

[1]NCE trades include carloads of barrels and blocks sold on National Cheese Exchange.
[2]American and total cheese manufactured were converted to carloads using 40,000 lbs. per carload.
[3]American includes Cheddar, Colby, granular, stirred curd, washed curd, and Monterey Jack.
[4]All cheese includes all types of cheese including cream cheese but excluding cottage cheese.

Figure 3.1
Barrel and Block Sales on NCE, 1989-93
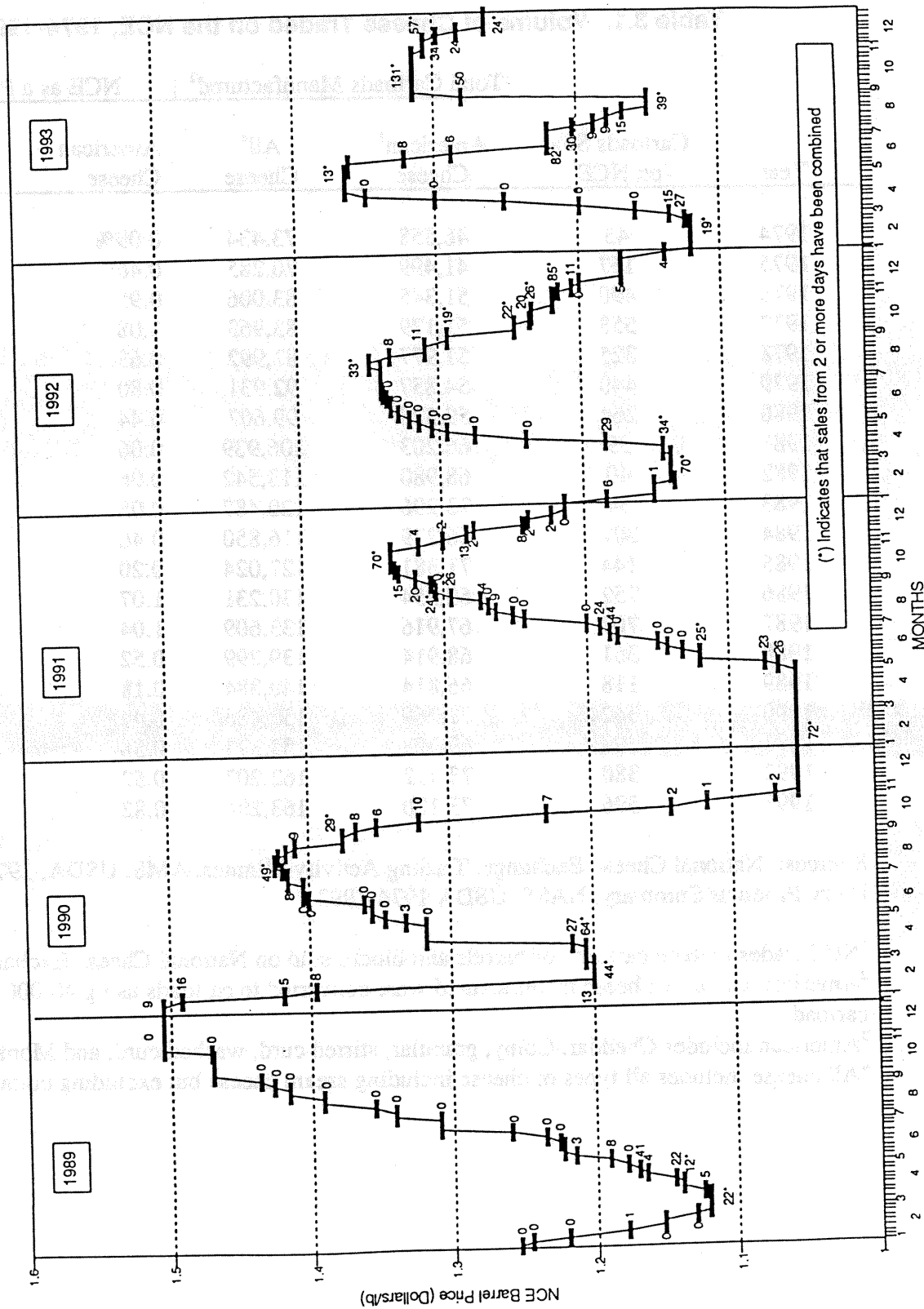
indicate that the price remained unchanged for a number of weeks. The longest such period was November 11, 1990, to May 26, 1991, when NCE prices were below the price support level.

Most changes in price, often including very large ones, resulted from bids to buy or offers to sell that did not result in actual transactions. Frequently prices rose or fell by substantial amounts over a number of trading days without any cheese actually traded. For example, from May 12, 1989, through November 3, 1989, the price per pound for barrels rose from $1.19 to $1.505 on bids and increased bids without a single consummated transaction. Each year the largest daily price increases most often occurred with no transactions.

Table 3.2 summarizes the frequency of price changes within trading sessions (usually in 0.25 cent increments) that occurred with and without transactions. For total barrel and block activity combined, prices changed without transactions about nine times as frequently as with transactions.[41] Overall trading activity patterns are quite similar for barrels and blocks.

The following statement of a sometime buyer on the NCE illustrates the potential impact of buying even a few loads of cheese on the thinly traded NCE.

> If we had competed with [Company X] for the bid lead for barrels, (1) we may have secured 5-8 loads, but (2) the barrel market would have closed at a significantly higher level (4-6 cents).[42]

On the day referred to above, this company did make one bid and an increased bid for three loads of barrels. These bids, though not filled, increased the NCE barrel price 0.25 cents. On the other hand, the company "had secured 8-10 loads (barrels and 640's) of cheese for

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[41]   The pattern was about the same for price increases and price decreases.

[42]   [[Source deleted in public report as not essential.]]

Table 3.2. Frequency of Price Changes Associated with Various Types of Trading Activity, 1988-1993

							Number of Actions[1]								
Type of Activity	1988		1989		1990		1991		1992		1993		Total 1988-1993	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Barrels and Blocks														
Price Changed with a Trade	37	6	9	1	54	4	53	7	51	6	83	7	287	5
Price Changed without a Trade	207	35	410	59	748	53	318	40	366	45	532	42	2581	46
Price Unchanged with a Trade	70	12	20	3	115	8	99	12	89	11	145	11	538	10
Price Unchanged without a Trade	281	47	260	37	490	35	334	42	288	36	509	40	2162	39
Total Actions	595	100	699	100	1407	100	804	100	794	100	1269	100	5568	100
Barrels														
Price Changed with a Trade	33	8	4	1	18	3	29	7	26	7	38	6	148	5
Price Changed without a Trade	109	27	209	49	337	64	159	36	175	45	277	41	1266	44
Price Unchanged with a Trade	69	17	19	4	45	9	62	14	37	10	78	11	310	11
Price Unchanged without a Trade	189	47	197	46	123	24	191	43	151	39	290	42	1141	40
Total Actions	400	100	429	100	523	100	441	100	389	100	683	100	2865	100
Blocks														
Price Changed with a Trade	4	2	5	2	36	4	24	7	25	6	45	8	139	5
Price Changed without a Trade	98	50	201	74	411	46	159	44	191	47	255	44	1315	49
Price Unchanged with a Trade	1	1	1	0	70	8	37	10	52	13	67	11	228	8
Price Unchanged without a Trade	92	47	63	23	367	42	143	39	137	34	219	37	1021	38
Total Actions	195	100	270	100	884	100	363	100	405	100	586	100	2703	100

Source: National Cheese Exchange, Trading Activity Minutes, AMS, USDA, 1988-1993.

[1] An action refers to bids and offers whether or not they result in a transaction.

processing...just prior to today's market."[43] Since these loads were purchased in the spot market,

they did not exert an upward pressure on the market.

An even more dramatic illustration of the thinness of trading occurred when Pizza Hut

attempted to sell three loads of blocks on the Exchange May 13, 1994. The block price dropped

10.5 cents per pound during the session without Pizza Hut selling a single load.[44]

An indication of the thinness of NCE trading is that even small companies may avoid

selling for fear of lowering prices. The president of Edelweiss Cheese Company said he did not

offer cheese on occasion because he did not want to lower the Exchange price. When he did not

sell on the NCE, he sold the cheese in the spot market the following week.[45]

The preceding facts illustrate three frequent characteristics of so-called "thin" markets:

(a) the small percentage of total cheese production actually traded on the Exchange, (b) price

changes on the NCE most often resulting from bids to buy or offers to sell rather than from

consummated transactions, and (c) the extreme sensitivity of the Exchange price to relatively

small purchases or sales. We turn next to a fourth factor relevant to the competitive

performance of thin markets, the concentration of transactions among relatively few traders.

Number and Relative Size of Traders

In perfectly competitive cash auction markets there are sufficient traders so that (a) each

buyer and each seller has a relatively small influence, such that none, acting alone, can affect

price or output; (b) buyers and sellers are well informed; and (c) there are no barriers to entry

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[43]   [[Source deleted in public report as not essential]]

[44]   See Chapter 4, pp. 35-36.

[45]   Interview of Edelweiss Cheese Company by Matthew J. Frank, Assistant Attorney
         General, State of Wisconsin, February 9, 1988, p. 1.

facing new traders. In such a market, price is determined by impersonal market forces, not by the interests, desires or whims of individual traders. Such conditions, according to economic theory, maximize social welfare.

The competitive ideals of economic theory are seldom realized in real world markets. Close approximations exist in heavily traded securities markets and many agricultural futures markets. On the other hand, markets for most manufactured products do not meet the conditions of perfectly competitive markets. Economic theory predicts and empirical studies verify that a market's structural characteristics and the conduct of various market participants determine how well it performs.[46]

Important structural characteristics include the concentration of purchases among leading buyers and the concentration of sales among leading sellers. Also important are whether any market participants enjoy competitive strategic advantages over other traders, whether traders have equal access to market information, and whether they make price and output decisions independently of one another. As a result, it is necessary to examine the actual market conduct of leading market participants as well as the market's structure.[47] Much of the remainder of this study examines market conduct. But first we examine the concentration of trading on the NCE.

In theory, other things being the same, the intensity of competition diminishes as the concentration of trading increases. Many empirical studies have verified this theory for both

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[46] F.M. Scherer and David Ross, *Industrial Market Structure and Economic Performance*, 1990.

[47] *Id.*

industrial and auction markets.[48] One measure of market concentration is the number of traders. Other measures are designed to capture the size distribution of traders. The most commonly used such measure is the *concentration ratio*, which measures the share of sales and purchases held by the largest participants in a market. In recent years, economists and public regulatory bodies have made increased use of the Herfindahl-Hirschman Index (HHI), which is the sum of the squares of the market participants' individual market shares.[49] The virtue of this measure is that squaring market shares gives greater weight to the market shares of the leading firms.[50]

The United States Department of Justice and the Federal Trade Commission have classified markets based on HHIs as follows:[51]

HHI below 1000:	Unconcentrated market
HHI 1000 to 1800:	Moderately concentrated market
HHI over 1800:	Highly concentrated market

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[48]   Leonard Weiss (ed.), *Concentration and Price*, MIT Press,1989. This comprehensive review of the literature covers 121 studies, including such diverse American industries as airlines, beef packing, cement, banking and supermarkets, as well as several auction markets. Based on his review of these studies, Weiss concludes that the evidence "seems to give overwhelming support to the concentration-price hypothesis." *Id*, p. 268. For auction markets see McAffee and McMillan, *op. cit.*

[49]   For example, if a market had 10 sellers, each with a share of 10%, the HHI would equal 1000, i.e., 10 x 10 = 100 x 10 sellers = 1000.

[50]   George Stigler, *The Organization of Industry*, Richard Irwin Co., 1968, pp. 261-267.

[51]   Department of Justice and Federal Trade Commission, *Horizontal Merger Guidelines*, April 2, 1992, Section 1.51.

In the context of horizontal merger analysis, the antitrust agencies presume that increases of 100 points or more in markets with HHIs of 1800 and over "are likely to create or enhance market power or facilitate its exercise."[52]

Trading on the NCE has always been concentrated among a relatively few traders.[53] Table 3.3 displays for each year during 1974-1993 the total number of traders selling blocks and barrels on the NCE; the concentration ratios, CR1 to CR5, which refer to the combined market shares of the top one to five firms; and the HHIs. In only one year during this period were there more than nine sellers. In all years, the five largest sellers accounted for over 87 percent of total carloads of barrels and blocks sold on the NCE. Seller HHI values ranged from a low of 1759 in 1986 to a high of 8251 in 1989 (Table 3.3).

Table 3.4 displays for each year during 1974-1993 the degree of concentration among buyers on the NCE. The number of buyers ranged from three in 1982 to 14 in 1979. In all but two years, the five largest buyers accounted for over 90 percent of barrel and block sales. The HHI values ranged from a low of 1675 in 1980 to a high of 7324 in 1986.

Although both NCE sales and purchases of total barrels and blocks were very highly concentrated in virtually all years, seller concentration was generally higher than buyer concentration. This was particularly true during 1988-1993, when the seller HHI averaged 5990,

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[52] *Id.*, Section 1.51. "The presumption may be overcome by a showing that [other] factors...make it unlikely that the merger will create or enhance market power or facilitate its excise [despite the presence of high market concentration]." *Id.*

[53] For a description of concentration in earlier years see Arthur Miller, *op. cit.*

Table 3.3. Seller Concentration on the National Cheese Exchange, 1974-1993 Barrel and Block Sales

Year	Carloads Traded	No. of Sellers	CR1	CR2	CR3	CR4	CR5	HHI
1974	43	9	39.5 (L)	58.1 (K)	69.8 (DP)	79.1 (BF)	88.4 (MA)	2255
1975	167	8	47.6 (K)	60.2 (BA)	72.9 (B)	84.9 (L)	91.6 (BF)	2806
1976	490	6	64.7 (L)	83.3 (K)	93.1 (BF)	96.5 (B)	99.4 (KP)	4647
1977	553	8	74.9 (L)	84.6 (KP)	91.1 (K)	95.3 (BF)	99.1 (B)	5774
1978	325	9	78.8 (L)	86.8 (K)	90.8 (S)	93.2 (B)	95.4 (BN)	6302
1979	440	4	63.0 (K)	82.3 (L)	98.9 (B)	100.0 (S)	---	4613
1980	264	6	65.2 (L)	86.0 (K)	92.4 (B)	96.6 (BF)	99.2 (TD)	4745
1981	39	4	41.0 (B)	82.1 (L)	97.4 (K)	100.0 (MA)	---	3609
1982	40	3	55.0 (L)	80.0 (MA)	100.0 (K)	---	---	4050
1983	34	6	58.8 (L)	76.5 (BF)	88.2 (K)	94.1 (B)	97.1 (MG)	3962
1984	307	8	44.3 (BN)	78.8 (L)	94.1 (DS)	95.8 (K)	97.4 (B)	3397
1985	144	6	54.2 (BN)	78.5 (L)	96.5 (B)	98.6 (K)	99.3 (MG)	3856
1986	752	12	29.3 (BN)	46.4 (MI)	61.7 (L)	75.3 (DS)	87.8 (K)	1759
1987	707	9	47.0 (K)	71.3 (L)	83.2 (DS)	89.5 (MI)	95.0 (BN)	3018
1988	361	6	76.7 (K)	89.5 (L)	98.3 (BN)	99.7 (DS)	98.9 (B)	6130
1989	118	5	90.7 (K)	94.9 (MG)	97.5 (MI)	99.2 (L)	100.0 (DS)	8251
1990	342	9	56.4 (K)	74.6 (AP)	84.8 (MA)	93.9 (DS)	96.2 (N)	3710
1991	399	8	85.0 (K)	89.5 (B)	92.0 (L)	96.0 (AP)	97.5 (MK)	7266
1992	380	8	67.9 (K)	76.3 (BN)	84.2 (AP)	89.7 (B)	92.9 (L)	4800
1993	596	9	74.3 (K)	89.6 (DS)	93.3 (AP)	96.1 (B)	97.7 (BN)	5784

Source: National Cheese Exchange, Trading Activity Minutes, AMS, USDA, 1974-93.

Notes: (1) CR refers to the concentration ratio measure of market concentration. CR1 refers to the percent of sales made by the five largest sellers. The codes in column CR1 identify the largest seller. CR5 refers to the percent of sales made by the five largest sellers. The codes in columns CR2 to CR5 represent the second to fifth largest sellers in each year. HHI refers to the Herfindahl-Hirschman Index of Market Concentration; it is calculated by summing the squares of the individual market shares of all firms selling on the NCE.

(2) Letters in parentheses are trader codes. AP=Alpine Lace; B=Borden; BF=Beatrice Food (Includes trades of Pauly, acquired in 1984); BN=Bongards; DS=Dairystate; K=Kraft; L=Land O' Lakes; MA=Marathon; MG=Masters Gallery; MI=Mid Am; MK=Marketing Association; N=Northern Wisconsin; S=Schreiber; TD=Twin Dakota. BA, DP, and KP are unidentified.

Table 3.4. Buyer Concentration on the National Cheese Exchange, 1974-1993 Barrel and Block Purchases

Year	Carloads Traded	No. of Buyers	CR1	CR2	CR3	CR4	CR5	HHI
1974	43	5	44.2 (B)	81.4 (S)	95.3 (FR)	97.7 (CA)	100.0 (CH)	3542
1975	167	9	59.9 (S)	78.4 (B)	88.6 (CC)	92.2 (L)	94.6 (PC)	4061
1976	490	13	42.4 (S)	68.8 (B)	85.5 (CH)	89.2 (FR)	92.2 (K)	2808
1977	553	9	58.0 (S)	83.0 (B)	89.5 (AM)	95.7 (CH)	97.1 (L)	4077
1978	325	8	50.5 (S)	73.5 (CH)	83.1 (B)	88.6 (K)	92.6 (N)	3237
1979	440	14	57.3 (S)	75.7 (CH)	84.3 (B)	88.2 (W)	91.1 (CL)	3730
1980	264	10	27.3 (S)	50.4 (B)	64.0 (W)	71.6 (BF)	78.0 (ND)	1675
1981	39	6	30.8 (L)	53.8 (B)	71.8 (W)	87.2 (S)	94.9 (AN)	2124
1982	40	3	40.0 (CL)	75.0 (S)	100.0 (B)	--	--	3450
1983	34	5	32.4 (MI)	55.9 (K)	79.4 (BF)	97.1 (S)	100.0 (L)	2474
1984	307	7	59.6 (K)	77.9 (BF)	85.3 (B)	92.2 (S)	96.4 (MI)	4016
1985	144	5	68.1 (K)	91.7 (BN)	95.1 (MI)	98.6 (S)	100.0 (BF)	5215
1986	752	4	84.4 (BF)	98.3 (K)	99.9 (MG)	100.0 (MI)	--	7324
1987	707	7	76.4 (BF)	87.0 (S)	92.5 (L)	96.9 (MA)	99.2 (B)	6001
1988	361	10	32.7 (BF)	54.3 (S)	70.1 (L)	78.4 (AM)	86.1 (B)	1961
1989	118	7	47.5 (AM)	71.2 (S)	82.2 (BF)	89.8 (L)	94.1 (EM)	3031
1990	342	11	50.3 (BF)	64.3 (MI)	77.8 (MG)	84.2 (K)	90.4 (L)	3012
1991	399	8	34.3 (MI)	65.2 (S)	86.5 (BF)	91.5 (AM)	95.5 (MG)	2631
1992	380	9	43.4 (BF)	78.2 (MI)	87.1 (S)	94.7 (AM)	96.3 (N)	3237
1993	596	9	36.9 (BF)	64.6 (MI)	81.0 (L)	88.8 (S)	93.8 (AM)	2499

Source: National Cheese Exchange, Trading Activity Minutes, AMS, USDA, 1974-93.

Notes: (1) CR refers to the concentration ratio measure of market concentration. CR1 refers to the percent of sales on the NCE by the largest seller. CR5 refers to the percent of sales made by the five largest sellers. The codes in column CR1 identify the largest seller. The codes in columns CR2 to CR5 represent the second to fifth largest sellers in each year. HHI refers to the Herfindahl-Hirschman Index of Market Concentration; it is calculated by summing the squares of the individual market shares of all firms selling on the NCE.

(2) Letters in parentheses are trader codes. AM=AMPI; AN=Anderson Clayton; B=Borden; BF=Beatrice Foods (includes trades of Pauly, acquired in 1984);
BN=Bongards; CC=Cheez Co; CH=Churny; CL=Clearfield; EM=Empire; FR=Frigo; K=Kraft; L=Land O' Lakes; MA=Marathon; MG=Masters Gallery; MI=Mid-Am;
N=Northern Wisconsin; ND=Northwood Dairy; N=Dorman; PC=Pacific Cheese; S=Schreiber; W=Wohlt.

whereas the buyer HHI averaged 2729. Such disparity in concentration is relevant because it may provide an index of the relative market strength of sellers versus buyers.[54]

In recent years, concentration has been especially high among barrel sellers on the NCE. During 1988-1993, the average HHI of barrel sellers was 7471, whereas that of block sellers was 4179. However, even block sales concentration was high: the HHI was below 3,000 in only four of the 19 years. Kraft was particularly active as a seller on the barrel market (Appendix Tables 3.3a-3.4b).

In sum, the NCE is a very thin market with exceptionally high seller and buyer concentration during 1988-1993: seller HHI's averaged 5,990 and buyer HHI's averaged 2,729. Both were well above the threshold of 1,800 that the United States Justice Department uses in identifying "highly concentrated" markets. Such high concentration levels imply that such markets are predisposed to noncompetitive behavior, either by a dominant firm or by tacit or explicit cooperation among traders.[55]

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[54]   Scherer and Ross, *op. cit.*, pp. 523-531.

[55]   Department of Justice, *op. cit.*, Scherer and Ross, *op. cit.*, 234-260.

Appendix Table 3.1. Number of Cheese Companies and Share of Value of Shipments by Leading Cheese Manufacturers, 1947-1992

Year	Companies	Value of Shipments (millions	Percent Accounted for by--			
			4 Largest Firms	8 Largest Firms	20 Largest Firms	50 Largest Firms
1947	1,313	$458	27	32	40	NA
1954	1,220	551	25	30	39	NA
1958	1,095	762	35	42	50	59
1963	982	1,070	45	50	59	68
1967	891	1,534	45	53	62	71
1972	739	2,754	40	51	62	74
1977	660	5,528	38	50	62	74
1982	575	9,487	35	46	60	74
1987	508 (216)[1]	10,776	43	55	68	82
1992	418	15,872	N.A.	N.A.	N.A.	N.A.

Source: *Concentration Ratios in Manufacturing Industry, 1958*, Bureau of the Census, Part 1; *1982 Concentration Ratios in Manufacturing*, Bureau of the Census; *Concentration Ratios in Manufacturing, 1987*, Bureau of the Census, 1992 Census of Manufactures, Industry Series, Dairy Products, Bureau of the Census.

Note: 1947-1954 is for natural cheese (SIC 2022); 1963-1992 is for natural and processed cheese (SIC 2022). Value of shipments is reported on an SIC "industry" basis for 1947 and 1954, and on an SIC "product class" basis for 1958-1992. Market shares are calculated on an "industry" basis for 1947-1958 and 1987. 1963-1982 market shares are calculated on a "product class" basis, which typically are one to two percentage points higher at the four-firm level than when calculated on an "industry" basis.

[1] Companies with value of shipments of $100,000 or more. *1987 Census of Manufacturers*, Industry Series, Dairy Products, p. 2013-15.

Appendix Table 3.2. Number of Cheese Plants and Value of Shipments, United States and Wisconsin, 1850-1992

Year	United States		Wisconsin		Wisconsin as Percent of U.S.	
	Cheese Plants	Value of Shipments[a]	Cheese Plants	Value of Shipments	Cheese Plants	Value of Shipments
		------------Shipments in Millions------------				
1850	8	$0.07	N/A	N/A	--	--
1860	2	0.01	N/A	N/A	--	--
1870	1313	16.77	54	$0.25	4.1%	1.5%
1880	N/A	N/A	N/A	N/A	--	--
1890	N/A	N/A	N/A	N/A	--	--
1900	N/A	N/A	N/A	N/A	--	--
1909	3560	44	N/A	N/A	--	--
1919	3530	143	2323	91.46	65.8	63.8
1929	2758	111	1963	64.97	71.2	58.7
1939	2682	108	1817	52.90	67.8	48.9
1947	1811	457	1067	200.0	58.9	41.3
1954	1419	551	842	210.22	59.3	38.1
1958	1203	762	738	313.31	61.4	45.98
1963	1138	1,070	650	468.55	57.1	40.0
1967	1026	1,534	566	683.10	55.2	40.0
1972	872	2,754	446	1201.60	51.2	37.6
1977	791	5,528	378	2429.90	47.8	39.7
1982	704	9,487	324	4115.90	46.0	38.2
1987	644	10,776	269	4502.80	41.8	34.7
1992	576	15,872	204	5157.70	35.4	32.5

Source: Census of US Manufactures, Bureau of Census, US Department of Commerce (various years).

[a]The value of shipments for 1958-1992 are for SIC 2022 calculated on an SIC "product class" basis. Value of shipments for other years are calculated on an SIC "industry" basis. In recent years the latter overstate actual cheese sales because they include non-cheese products made in cheese plants. For example, cheese plant sales calculated on an "industry" basis for 1992 were $18,351 million for the U.S.

Appendix Table 3.3a. Seller Concentration on the National Cheese Exchange, 1974-1993

Barrel Sales

Year	Carloads Traded	No. of Sellers	CR1	CR2	CR3	CR4	CR5	HHI
1974	4	2	75.0 (K)	100.0 (BF)	--	--	--	6250
1975	131	5	58.8 (K)	73.3 (L)	86.3 (B)	94.7 (BF)	100.0 (BN)	3933
1976	367	5	70.8 (L)	83.1 (BF)	95.1 (K)	98.9 (KP)	100.0 (B)	5329
1977	464	7	76.7 (L)	86.6 (KP)	90.6 (K)	96.1 (B)	99.4 (BF)	6041
1978	272	7	81.3 (L)	88.6 (K)	91.9 (S)	94.9 (B)	97.1 (BN)	6686
1979	409	4	67.0 (K)	86.1 (L)	98.8 (B)	100.0 (S)	--	5015
1980	257	6	66.9 (L)	88.3 (K)	94.9 (B)	97.3 (BF)	99.2 (TD)	4991
1981	32	3	50.0 (B)	81.3 (L)	100.0 (K)	--	--	3828
1982	30	2	73.3 (L)	100.0 (K)	--	--	--	6089
1983	32	4	62.5 (L)	81.3 (BF)	93.8 (K)	100.0 (B)	--	4453
1984	282	7	41.1 (BN)	78.7 (L)	95.4 (DS)	97.2 (B)	98.6 (AN)	3389
1985	139	3	56.1 (BN)	81.3 (L)	100.0 (B)	--	--	4133
1986	326	11	53.4 (BN)	77.0 (L)	83.1 (B)	86.8 (S)	89.9 (K)	3491
1987	424	5	70.3 (K)	89.6 (L)	96.9 (BN)	99.5 (DS)	100.0 (MK)	5374
1988	350	4	79.1 (K)	90.3 (L)	99.4 (BN)	100.0 (B)	--	6472
1989	107	1	100.0 (K)	--	--	--	--	10000
1990	144	3	91.0 (K)	97.9 (DS)	100.0 (B)	--	--	8329
1991	288	3	90.3 (K)	96.5 (B)	100.0 (L)	--	--	8201
1992	209	5	66.0 (K)	81.3 (BN)	90.4 (B)	95.2 (AP)	100.0 (L)	4723
1993	401	7	83.8 (K)	91.3 (DS)	95.5 (B)	97.3 (BN)	98.5 (SH)	7101

Source: National Cheese Exchange, Trading Activity Minutes, AMS, USDA, 1974-93.

Notes: (1) CR refers to the concentration ratio measure of market concentration. CR1 refers to the percent of sales on the NCE by the largest seller. CR5 refers to the percent of sales made by the five largest sellers. The codes in column CR1 identify the largest seller. The codes in columns CR2 to CR5 represent the second to fifth largest sellers in each year. HHI refers to the Herfindahl-Hirshman Index of Market Concentration; it is calculated by summing the squares of the individual market shares of all firms selling on the NCE.

(2) Letters in parentheses are trader codes. AN=Anderson Clayton; AP=Alpine Lace; B=Borden; BF=Beatrice Foods (includes trades of Pauly, acquired in 1984);
BN=Bongards; DS=Dairystate; K=Kraft; KP=KP; L=LOL; MK=Marketing Association; S=Schreiber; TD=Twin Dakota.

Appendix Table 3.3b. Seller Concentration on the National Cheese Exchange, 1974-1993

Block Sales

Year	Carloads Traded	No. of Sellers	CR1	CR2	CR3	CR4	CR5	HHI
1974	39	9	43.6 (L)	56.4 (K)	69.2 (DP)	79.5 (MA)	87.2 (BF)	2439
1975	36	6	58.3 (BA)	75.0 (S)	86.1 (B)	91.7 (K)	97.2 (FR)	3873
1976	123	5	46.3 (L)	84.6 (K)	95.1 (B)	97.6 (BF)	100.0 (CH)	3731
1977	89	5	65.2 (L)	79.8 (K)	88.8 (BF)	97.8 (KP)	100.0 (S)	4627
1978	53	6	66.0 (L)	77.4 (K)	86.8 (KP)	94.3 (S)	98.1 (BF)	4653
1979	31	3	67.7 (B)	90.3 (L)	100.0 (K)	--	--	5193
1980	7	2	71.4 (BF)	100.0 (TD)	--	--	--	5918
1981	7	2	85.7 (L)	100.0 (MA)	--	--	--	7551
1982	10	1	100.0 (MA)	--	--	--	--	10000
1983	2	2	50.0 (MG)	100.0 (MA)	--	--	--	5000
1984	25	4	80.0 (BN)	88.0 (K)	96.0 (MG)	100.0 (N)	--	6544
1985	5	3	60.0 (K)	80.0 (MG)	100.0 (N)	--	--	4400
1986	426	8	27.9 (MI)	51.9 (DS)	71.6 (K)	82.4 (BN)	91.3 (L)	1987
1987	283	9	31.8 (L)	57.6 (DS)	73.5 (MI)	85.5 (K)	91.2 (MG)	2134
1988	11	3	63.6 (L)	90.9 (DS)	100.0 (MI)	--	--	4876
1989	11	4	45.5 (MG)	72.7 (MI)	90.9 (L)	100.0 (DS)	--	3223
1990	198	8	31.3 (AP)	62.6 (K)	80.3 (MA)	90.9 (DS)	94.9 (N)	2414
1991	111	6	71.2 (K)	85.6 (AP)	91.0 (MK)	95.5 (DG)	98.2 (DS)	5333
1992	171	7	70.2 (K)	81.9 (AP)	87.7 (GC)	93.0 (DG)	97.7 (N)	5147
1993	195	7	54.9 (K)	86.2 (DS)	95.4 (AP)	97.4 (NW)	98.5 (SH)	4081

Source: National Cheese Exchange, Trading Activity Minutes, AMS, USDA, 1974-93.

Notes: (1) CR refers to the concentration ratio measure of market concentration. CR1 refers to the percent of sales made by the five largest sellers. The codes in column CR1 identify the largest seller. CR5 refers to the percent of sales refers to the Herfindahl-Hirshman Index of Market Concentration; it is calculated by summing the squares of the individual market shares of all firms selling on the NCE.

(2) Letters in parentheses are trader codes. AP=Alpine Lace; B=Borden; BA=BA; BF=Beatrice Foods (includes trades of Pauly, acquired in 1984); BN=Bongards; CH=Churny; DG=Dairygold; DP=DP; DS=Dairystate; FR=Frigo; GF=Golden Cheese; K=Kraft; KP=KP; L=LOL; MA=Marathon; MG=Masters Gallery; MI=Mid-Am; MK=Marketing Association; N=Northern; S=Schreiber; TD=Twin Dakota.

Appendix Table 3.4a. Buyer Concentration on the National Cheese Exchange, 1974-1993

Barrel Purchases

Year	Carloads Traded	No. of Buyers	CR1	CR2	CR3	CR4	CR5	HHI
1974	4	2	75.0 (S)	100.0 (CA)	---	---	---	6250
1975	131	6	69.5 (S)	82.4 (CC)	90.8 (B)	95.4 (L)	98.5 (PC)	5097
1976	367	10	46.3 (S)	68.4 (B)	87.7 (CH)	91.8 (K)	94.6 (NF)	3038
1977	464	8	59.3 (S)	81.0 (B)	88.8 (AM)	96.1 (CH)	97.4 (L)	4105
1978	272	6	51.1 (S)	78.7 (CH)	89.3 (B)	96.0 (K)	98.9 (L)	3539
1979	409	11	57.0 (S)	76.8 (CH)	85.3 (B)	89.5 (W)	92.7 (CL)	3750
1980	257	10	27.2 (S)	49.0 (B)	63.0 (W)	70.8 (BF)	77.4 (ND)	1636
1981	32	6	37.5 (L)	59.4 (W)	78.1 (S)	87.5 (AN)	93.8 (K)	2402
1982	30	2	53.3 (CL)	100.0 (S)	---	---	---	5022
1983	32	4	34.4 (MI)	59.4 (BF)	84.4 (K)	100.0 (S)	---	2675
1984	282	7	64.9 (K)	80.9 (BF)	89.0 (B)	92.9 (MI)	96.1 (CL)	4568
1985	139	4	68.1 (K)	100.0 (BN)	98.6 (S)	100.0 (MI)	---	5584
1986	326	2	68.1 (BF)	100.0 (K)	---	---	---	5655
1987	424	6	67.9 (BF)	85.6 (S)	94.8 (L)	98.6 (B)	99.5 (N)	5027
1988	350	10	31.1 (BF)	53.4 (S)	69.7 (L)	78.3 (AM)	86.3 (B)	1918
1989	107	5	52.3 (AM)	78.5 (S)	87.9 (BF)	96.3 (L)	100.0 (N)	3596
1990	144	8	44.4 (BF)	69.4 (MG)	81.9 (L)	90.3 (S)	95.8 (N)	2863
1991	288	8	41.0 (S)	68.1 (MI)	88.5 (BF)	93.8 (AM)	96.2 (N)	2871
1992	209	7	56.0 (BF)	72.2 (S)	86.1 (MI)	94.3 (AM)	97.1 (N)	3670
1993	401	8	52.6 (BF)	77.1 (L)	88.5 (S)	93.0 (MI)	96.0 (AM)	3534

Source: National Cheese Exchange, Trading Activity Minutes, AMS, USDA, 1974-93.

Notes: (1) CR refers to the concentration ratio measure of market concentration. CR1 refers to the percent of sales on the NCE by the largest seller. CR5 refers to the percent of sales made by the five largest sellers. The codes in column CR1 identify the largest seller. The codes in columns CR2 to CR5 represent the second to fifth largest sellers in each year. HHI refers to the Herfindahl-Hirshman Index of Market Concentration; it is calculated by summing the squares of the individual market shares of all firms selling on the NCE.

(2) Letters in parentheses are trader codes. AM=AMPI; AN=Anderson Clayton; B=Borden; BF=Beatrice Foods (includes trades of Pauly, acquired in 1984);
BN=Bongards; CA=CA; CC=Cheez Co; CH=Churny; CL=Clearfield; K=Kraft; L=LOL; MG=Masters Gallery; MI=Mid-Am; N=Northern; ND=N. Dorman; NF=Northfield;
PC=PC; S=Schreiber; W=Woldt's.

Appendix Table 3.4b. Buyer Concentration on the National Cheese Exchange, 1974-1993

Block Purchases

Year	Carloads Traded	No. of Buyers	CR1	CR2	CR3	CR4	CR5	HHI
1974	39	4	48.7 (B)	82.1 (S)	97.4 (FR)	100.0 (CH)	---	3728
1975	36	5	55.6 (B)	80.6 (S)	91.7 (MA)	97.2 (F)	100.0 (FR)	3873
1976	123	7	39.0 (B)	69.9 (S)	84.6 (FR)	93.5 (CH)	97.6 (BG)	2791
1977	89	5	51.7 (S)	93.3 (B)	96.6 (FR)	98.9 (L)	100.0 (BF)	4417
1978	53	6	47.2 (S)	66.0 (N)	79.2 (FR)	88.7 (BG)	96.2 (L)	2916
1979	31	6	61.3 (S)	77.4 (BG)	87.1 (B)	93.5 (N)	96.8 (CC)	4173
1980	7	2	71.4 (B)	100.0 (S)	---	---	---	5918
1981	7	1	100.0 (B)	---	---	---	---	10000
1982	10	1	100.0 (B)	---	---	---	---	10000
1983	2	2	50.0 (S)	100.0 (L)	---	---	---	5000
1984	25	3	48.0 (S)	92.0 (BF)	100.0 (MI)	---	---	4304
1985	5	2	60.0 (MI)	100.0 (BF)	---	---	---	5200
1986	426	3	96.9 (BF)	99.8 (MG)	100.0 (MI)	---	---	9407
1987	283	2	89.0 (BF)	100.0 (MA)	---	---	---	8049
1988	11	2	81.8 (BF)	100.0 (MI)	---	---	---	7025
1989	11	3	45.5 (EM)	72.7 (BF)	100.0 (MI)	---	---	3554
1990	198	9	54.5 (BF)	77.8 (MI)	88.9 (K)	93.9 (MG)	96.5 (AM)	3674
1991	111	6	53.2 (MI)	76.6 (BF)	90.1 (MG)	94.6 (AM)	99.1 (S)	3598
1992	171	6	60.2 (MI)	88.3 (BF)	95.3 (AM)	97.1 (NW)	98.8 (AL)	4473
1993	195	7	75.4 (MI)	84.6 (AM)	91.3 (SH)	95.9 (BF)	97.4 (AL)	5840

Source: National Cheese Exchange, Trading Activity Minutes, AMS, USDA, 1974-93.

Notes: (1) CR refers to the concentration ratio measure of market concentration. CR1 refers to the percent of sales on the NCE by the largest seller. CR5 refers to the percent of sales made by the five largest sellers. The codes in column CR1 identify the largest seller. The codes in columns CR2 to CR5 represent the second to fifth largest sellers in each year. HHI refers to the Herfindahl-Hirshman Index of Market Concentration; it is calculated by summing the squares of the individual market shares of all firms selling on the NCE.

(2) Letters in parentheses are trader codes. AL=Alto; AM=AMPI; B=Borden; BF=Beatrice Foods (includes trades of Pauly, acquired in 1984); BG=Bit of Gold; CC=Cheez Co; CH=Churny; EM=Empire; F=Fisher; FR=Frigo; L=LOL; MA=Marathon; MG=Masters Gallery; MI=Mid-Am; N=Northern; NW=Northwood; S=Schreiber.