Price Leadership on the National Cheese Exchange

by

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I. Introduction

The National Cheese Exchange (NCE) is a centralized auction market in Green Bay, Wisconsin. Cheese manufacturers and marketers meet weekly for about 30 minutes to buy and sell carlots of bulk cheddar cheese to each other in 40 pound blocks or 500 pound barrels.[1] NCE sales account for less than one percent of all cheese made in the U. S. Each year about five sellers and five buyers make virtually all cheese trades.

The tiny volume traded in this obscure market by a few traders belies the far-reaching consequences of the prices that are established. NCE prices are used as the reference prices in formula-pricing practically all bulk cheese sold by cheese companies. The prices also are frequently used as the reference price in selling private label and weak company brands of finished natural and processed cheeses to food retailers, food service outlets, and industrial users. Finally, NCE prices largely determine the price of fluid milk used by cheese manufacturers and significantly influence the price of other dairy products.

Not surprisingly, prices determined by so few but affecting so many have been frequent targets of criticism and questions. Yet the last in-depth examination of the NCE was in the 1930s, as reported by Nicholls (1939, 1941).[2] This article reports some of the findings of a four-year

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[1] Barrel cheese is mainly used to make processed cheese products. Blocks are used mainly to make cut and wrapped natural cheese. Barrels accounted for 68 percent of NCE sales during 1988-1993. Sales are in 40,000 pound carlots.

[2] The Federal Trade Commission examined the predecessor to the NCE in 1928, 1936 and 1938. During 1940-1942, the U.S. Justice Department brought antitrust cases challenging price fixing in American, brick and Swiss cheese. The actions resulted in one consent decree and two dismissals (Geffen, 1951).

study of cheese pricing on the NCE.[3] In particular, the study tested the hypothesis that certain traders influenced NCE prices for their benefit during the six-year period 1988-1993. First, however, we review some potential problems of thinly traded markets. This is followed by an examination of the functions of the NCE, the motives of the traders, the reasons the NCE is an inefficient market, and the trading conduct of leading traders. We then present an econometric examination of the impact on NCE prices of leading traders. Because Kraft General Foods accounted for 75 percent of the sales on the NCE during 1988-1993, it receives particular attention.

II. Potential Problems of Thin Markets

The NCE is what market analysts call a "thin" market. Such markets pose potential problems where they serve as a reference price for formula-pricing a large share of sales made off the market. For example, the incentive to influence the NCE would be very different were it used to formula-price 5 percent of bulk cheese sales rather than the estimated 90 to 95 percent in recent years. As it is, during 1988-1993, the price on 0.2 percent of all cheese produced was used in setting the price for 90-95 percent. That simple fact creates a great incentive for attempting to influence the NCE, similar to the incentive big oil refiners had to manipulate the spot oil market in *Socony*.[4] It also complicates analysis of the NCE since two relevant submarkets must be kept in

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[3] Mueller, Marion, Sial, and Geithman (1996). This study is cited as NCE Report.

In 1992 the University of Wisconsin-Madison and the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) agreed to collaborate in an analysis of cheese pricing. DATCP agreed to use its authority to compel production of documents; the university agreed to assist DATCP in obtaining documents and in preparing a report for DATCP. Willard F. Mueller and Bruce W. Marion directed the study. A public report was released in March 1996. The research was funded by Special Grants appropriated by Congress and administered by the U.S. Department of Agriculture, and the College of Agriculture, University of Wisconsin-Madison.

[4] Antitrust companies will recognize the similarities between the NCE and the spot market in *Socony*, where the big oil refiners manipulated the spot market used as the reference price by the refiners in selling to jobbers. The practice violated Sherman 1. See *United States v. Socony*, 310 U. S. 150 (1940).

mind: the NCE and the contracted submarket that is priced off the NCE.

The potential adverse consequences of thin markets include manipulation of price, incorrect price signals causing misallocation of resources, and increased price volatility due to market illiquidity (Schrader 1980; Hayenga, 1979). Thinly traded markets do not necessarily perform poorly (a) if no single trader (or group of cooperating traders) is large enough to influence price to its (their) advantage and (b) if there are sufficient potential traders "waiting in the wings" capable of participating in trading at no significant disadvantage relative to the leading actual trader(s). Frequently, however, the competitive structure of thinly traded central markets differs significantly from that of the aggregate market.

The empirical evidence is mixed regarding the performance of thin markets (Caves, 1979; Tomek, 1980; Schrader, 1980). But while thin markets can be compatible with well-functioning markets, potential market manipulation in thin markets warrants close public scrutiny (Caves 1979).

The NCE has several characteristics of a thin market: relatively few transactions, few traders, and low absolute trading volumes. During 1988-1993, only 0.2 percent of all manufactured cheese was sold on the NCE, and prices typically were based on unfilled bids or uncovered offers (NCE Report: Table 3.2). About 90 percent of the price changes were based on unfilled bids or uncovered offers. On one occasion prices changed over a 25 consecutive-week period without a single trade. Of the 313 trading sessions in 1988-93, no barrels were traded in 53 percent of the sessions; no blocks were traded in 62 percent of the sessions.

While cheese manufacturing and marketing are only moderately concentrated, NCE trading is highly concentrated in both buying and selling. During 1988-1993, Kraft's average share of sales was 75 and that of the top five seller-traders was 97 percent. During this period,

the leading buyer-trader averaged 41 percent of all purchases, and the top five buyer-traders together averaged 93 percent (NCE Report: Tables 3.3 and 3.4)

III. Functions of the NCE

The NCE has two main functions: (a) to provide a cash market where members may buy and sell cheese and (b) to establish a "market opinion" or settlement price for bulk cheese, based on the day's last sale, highest bid, or lowest offer. There are conflicting beliefs as to the primary reason traders use the NCE. One view is that companies trade on the NCE primarily as an alternative outlet or source of cheese; the second view is that leading companies trade primarily to influence NCE prices, which are used in formula pricing 90-95 percent of bulk cheese bought and sold off the NCE.

If traders use the NCE primarily as an alternative outlet or source of supply, their trading patterns should be similar to those typically found in cash agricultural auction markets: (a) traders that manufacture and sell most of their bulk cheese off the NCE should be mainly sellers on the NCE and (b) traders that normally buy most of their bulk cheese from others off the NCE for processing and marketing purposes should be mainly buyers on the NCE. On the other hand, if firms trade primarily to influence NCE prices, their trading conduct may be the reverse of that expected in cash auction markets. We first tested these conflicting hypotheses by examining trading patterns over the 1980-1993 period. As expected in a cash auction market, during 1980-1987, manufacturing cheese companies that were net sellers of bulk cheese off the NCE were predominantly sellers on the NCE, selling 6.2 loads for each load they bought; cheese marketers that were net buyers of bulk cheese off the NCE were predominantly buyers on the NCE, buying 2.9 loads for each load they sold (NCE Report: 55).

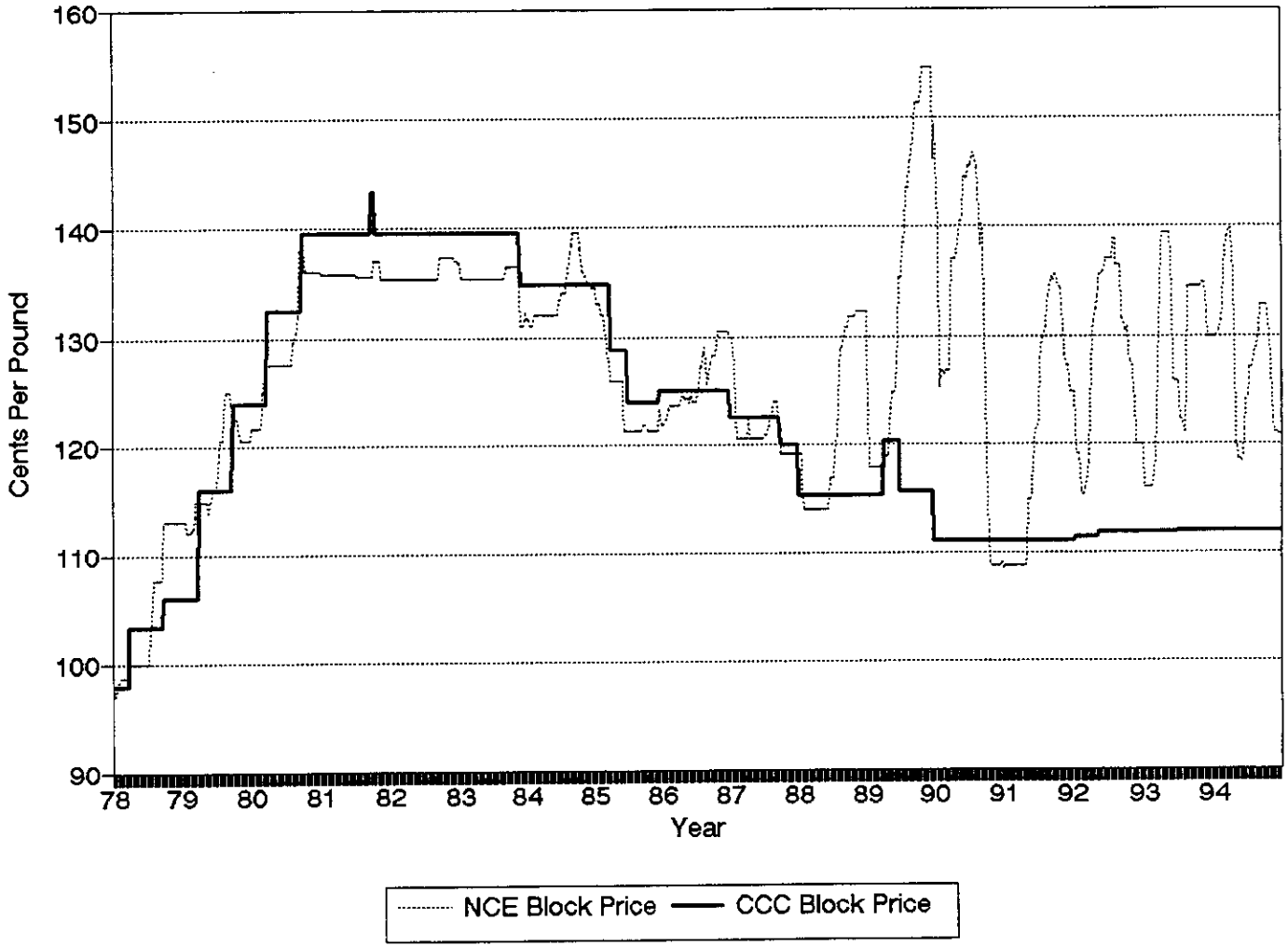
This trading pattern was reversed during 1988-1993, when some leading cheese

marketers became predominantly sellers and several leading manufacturers became predominantly buyers (NCE Report: 56). The most significant reversal was that of Kraft, the largest buyer of bulk cheese off the NCE. During 1980-1987, Kraft bought 507 loads and sold 411. Of the 411 loads sold, Kraft sold 332 loads in 1987, reflecting the fact that beginning in August 1986 Kraft became exclusively a seller-trader on the NCE. During 1988-1993, Kraft sold 1617 loads and bought 22 loads. (The 22 loads were purchased to influence the spread between block and barrel prices, not because Kraft needed the cheese [NCE Report: 111].) Also, beginning in 1988, the three leading agricultural cooperative cheese manufacturers reversed their roles, from being mainly sellers to being mainly buyers on the NCE (Associated Milk Producers, Inc.--AMPI; Land O' Lakes, Inc.; and Mid-America Dairymen, Inc.--Mid-Am). The cooperatives reversed their trading conduct about one and one-half years after Kraft had become exclusively a seller-trader in August 1986, suggesting that their reversals were a response to that of Kraft. During 1988-1993, these traders bought about 10 loads for every load they sold.

The shift in trading patterns occurred at the same time that the NCE became more important in the cheese price discovery process. During 1980-1987, cheese prices were strongly influenced by the government price supports through CCC (Commodity Credit Corporation) purchases.[5] There was little opportunity for firms trading on the NCE to have much influence. Cheese prices became largely market driven in 1988 when NCE prices rose above government support levels and have remained there since. The volatility and range of cheese prices increased sharply during 1988-1993, the period on which this study focused. In this environment, cheese companies had both greater opportunity and greater incentive to influence prices (Figure 1).

[5] Since 1981, the Federal government has supported the price of manufacturing milk by purchasing bulk cheddar cheese, butter and nonfat dry milk. The CCC price becomes a floor for the prices of these products.

Fig.1: NCE & CCC Block Cheese Prices
Weekly: 1978-94



In sum, the trading patterns of leading cheese manufacturers and marketers during 1980-1987 is consistent with the hypothesis that leading traders use the NCE primarily as an alternative outlet or source of cheese. Trading conduct during 1988-1993, however, is consistent with the hypothesis that some leading traders are motivated primarily by a desire to influence NCE prices. In addition to the above evidence of trading conduct, there also is considerable documentary evidence that leading traders use the NCE to influence prices (NCE Report: 53-54, 73-76).

IV. Motives of Traders

Differences in the business characteristics of leading traders help explain why some were primarily buyers and others primarily sellers on the NCE during 1988-1993. Essentially, some traders benefit from higher NCE prices and some from lower NCE prices, other things being the same. To understand this concept, one must understand how an individual company's input costs and selling prices are related to NCE prices.

We examined the business characteristics of the nine leading traders on the NCE during 1988-1993. Five of these traders--Kraft General Foods, Inc.; Borden, Inc.; Alpine Lace Brands, Inc.; Beatrice Cheese, Inc.; and Schreiber Foods, Inc.--are primarily cheese marketers that buy all or much of the bulk cheese required to make finished cheeses sold to food retailers, food service companies and industrial users; three leading traders are agricultural cooperatives that are manufacturers of cheese: Mid-Am, Land O' Lakes, and AMPI; and one trader is a broker: Dairystate Brands, Inc.

As cheese marketers, Kraft, Borden, Alpine Lace, Beatrice and Schreiber have certain characteristics in common. They all buy bulk cheese from manufacturers at NCE-based formula prices. NCE prices also largely determine the cost of milk used in making cheese and thus exert the dominant influence (roughly 75-85 percent) over the cost of cheese-making. There are,

however, significant differences among the five cheese marketers. Kraft, Borden, and Alpine Lace all sell cheese under their own brand names. Kraft sells about 75 percent of its finished cheese products to retailers under highly differentiated Kraft brands that command significant price premiums over lesser brands. Borden, the second largest marketer of branded processed cheese to retailers, sells nearly all of its cheese under the Borden brand, which also commands a price premium over private label and weaker brands but a lower premium than Kraft brands.

Beginning in 1985, Kraft quit linking its selling prices for finished cheese to the NCE and instead sold its brands at wholesale list prices--which frequently remain unchanged for many months. Since then there has been little correlation between NCE prices and the wholesale prices of either Kraft brands or those brands that often follow Kraft's prices. Although Kraft cannot disregard the prices of other cheese brands, the relative strength of Kraft brands provides a significant degree of discretion in pricing, particularly in the short term.[6] Borden and Alpine Lace, like Kraft, also sell finished product to retailers at list prices not coupled to NCE price. Gross profit margins for these three companies come mostly from the difference between the cost of cheese they buy or make and the wholesale price of finished product they sell. Since the bulk cheese they buy is priced off the NCE, and since the cost of bulk cheese is such a large part of total finished product costs, Kraft, Borden and Alpine Lace all have a strong financial interest in lower NCE prices, all else remaining the same. This is especially true for Kraft.

Figure 2 shows the average monthly wholesale price of Kraft processed cheeses and the average monthly NCE prices of barrel cheese during 1989-1991. (Actual prices on the vertical scale are not shown to avoid disclosure. See note in Figure 2.) A regression of Kraft's monthly

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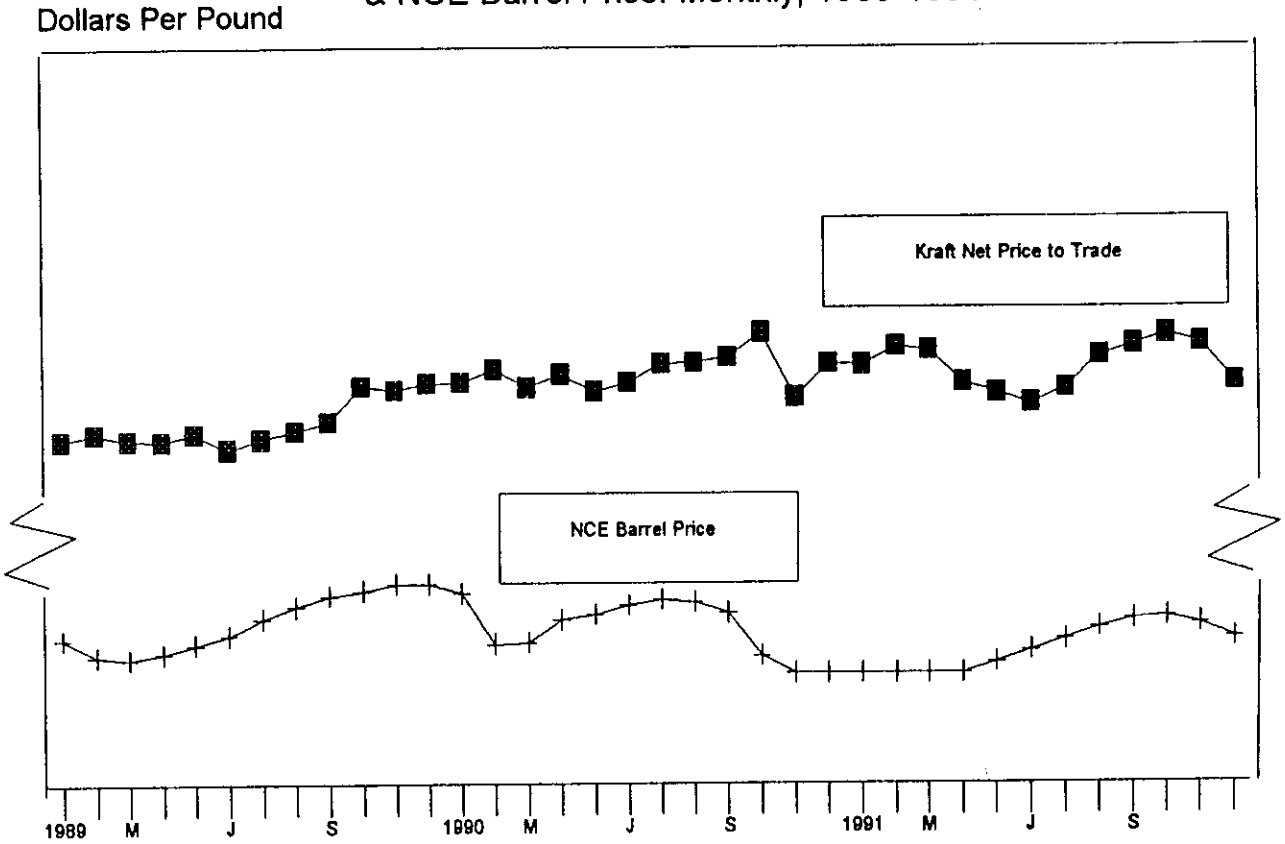
[6] Between 1981 and 1988, Kraft increased the price gap between Kraft brands and private label brands--which Kraft viewed as its leading competition--without losing overall market share (NCE Report: 160). Contributing to short-term discretion in pricing to retailers are the latter's slowness in reflecting fully and immediately changes in wholesale prices.

Fig.2: Kraft Net Price of Proc.Cheese
& NCE Barrel Price. Monthly, 1989-1991



Source: Derived from "Kraft Retail Price, Kraft Net Price & NCE, Processed Cheese," Kraft General Foods, Inc., KGF 16912

Note: The values on the Y axis have been deleted and the scales of the net price to trade and NCE prices are altered to avoid disclosure. This information has been redacted from the repot at this time pursuant to an agreement with Kraft General Foods, Inc., that there will be a subsequent judicial resolution of a good-faith dispute over the trade secret status of the information.

net prices to the trade for processed and natural cheese as a function of average monthly NCE barrel and block prices found no statistically significant relationship between these prices during 1989-1991 (NCE Report: 162). This was as expected since Kraft sells branded products at prices that are not coupled to NCE prices. Regressing Kraft's monthly average gross margin for processed cheese (as measured by Kraft's net price to the trade less the NCE barrel price) on NCE barrel prices yielded a coefficient on the gross margin of -0.988 with a t-value of -4.73. This indicates that as NCE barrel prices decreased by 10 cents per pound, Kraft's gross margin on processed cheese increased by about the same amount. A similar regression analysis for Kraft's natural cheese products as a function of NCE block cheese price yields a coefficient on the gross margin of -0.730 with a t-value of -3.51. This implies that when NCE block prices decreased by 10 cents per pound, Kraft's gross margins for natural cheese increased by 7.3 cents per pound.

Beatrice and Schreiber differ somewhat from the other three leading marketers in that neither has strong consumer brands for finished cheese products. Both sell to customers at wholesale prices which are either formula-priced off the NCE or else which compete with products of other sellers that formula-price off the NCE. As a result, both their buying and selling prices tend to reflect NCE prices, causing their interest in the level of NCE prices to differ from that of Kraft, Borden, and Alpine Lace. Even though a marketer may buy a good share of its bulk cheese, the fact that it buys bulk cheese and sells processed cheese at NCE-based formula prices means it may profit from higher NCE prices. Since bulk cheese costs may represent 70 percent or less of the total cost of making processed cheese products, a 10 cent per pound increase in NCE price will increase the cost of making finished products by 7 cents per pound but will increase the selling price by 10 cents per pound. On balance, however, the potential benefit of higher NCE prices to either Beatrice or Schreiber seems modest compared to the potential benefits marketers

with strong brands may derive from lower NCE prices (NCE Report: 61-62).[7]

Beatrice and Schreiber also have an incentive to buy when NCE prices are below those in the spot market, which is normally the case.[8] But the amount they can buy on the NCE in a given week is limited by the amount they are obligated to buy from committed suppliers.

The three leading agricultural cooperative buyer-traders have two reasons for preferring higher NCE prices. First, the farmer-members of cooperatives benefit directly from higher prices for milk used in making cheese. To the extent that these cooperatives represent the interests of their farmer-owners, they prefer higher NCE prices. Second, although the cooperatives sell mainly bulk cheese, they sell some under private label or weak brands of processed cheese. This gives them the same interests as Beatrice and Schreiber in higher NCE prices, although the potential benefits from this source are modest.

Since Dairystate is a broker, its interest in NCE prices presumably reflects those of its customers. Insofar as it sells mostly for cheese manufacturers, it would be primarily a seller on the NCE, as it was during both 1980-1987 and 1988-1993.

In sum, the business characteristics of traders determine whether, other things being the same, they benefit from lower NCE prices or higher NCE prices. Based on an analysis of the business characteristics of leading traders, we hypothesize that most fall into two categories: (a) traders benefiting from lower prices: Kraft, Borden and Alpine Lace; and (b) traders benefiting from higher prices: Beatrice, Mid-Am, Schreiber, Land O' Lakes, and AMPI. Thus, if traders use the NCE primarily to influence prices, their interests in the level of prices explain why traders in

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[7] Statistical analyses implied that during 1989-1992 the gross margins of both companies rose only modestly compared to increases in NCE prices (NCE Report: 160)

[8] The *spot market*, as used here, refers to direct transactions among cheese companies with short-term shortages or surpluses. In recent years about 5-10 percent of all manufactured cheese has been sold in the spot market.

category (a) are predominantly seller-traders and those in category (b) are predominantly buyer-traders.

Various documentary evidence and statements of traders support the above characterizations of the trading motives of leading traders. There is evidence that Kraft views its trading activity on the NCE as an important tool in managing cheese costs. For example, in early 1990, McKinsey Company consultants (with the assistance of Kraft personnel) developed a presentation to Kraft senior management entitled Short-Term Cheese Options (NCE Report: 73-75; 148-149). The document summarized the short-term problems facing Kraft, including the likelihood that, "If the current relationship between Kraft wholesale price and raw material costs does not improve, the result will be a [...] per month shortfall versus financial plan."[9] The document then spells out several "options" open to Kraft, including three alternative NCE trading actions that would drive prices down, hold them steady, or allow them to increase.

An additional factor influencing trader motives is that the NCE often has lower prices than the spot market. Indeed, there is extensive evidence that most typically Kraft traded on the NCE at a loss and off the NCE at a gain (NCE Report: 65-73; 144-159). According to Kraft's own calculations, during 1987-1992 for its sales of barrels and blocks it realized a loss of 2.4 cents per pound on NCE sales, an average gain of 2.65 cents per pound on spot sales, and an average gain of 0.19 cents per pound on CCC sales (NCE Report 69). Thus, there was a net difference of over 5.5 cents per pound between NCE sales and spot sales.[10]

To sell on the Exchange at a loss when other more profitable outlets are available constitutes trading against interest. Such behavior was irrational business conduct if Kraft was

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[9] The amount of Kraft's shortfall in profits was deleted pending judicial resolution of the trade secret status of this and other matters that Kraft claims are trade secrets.

[10] See note 8 for definition of spot sales.

seeking only to maximize profits on NCE sales. But Kraft had a strong profit motive for selling at a loss if doing so reduced NCE prices: whereas Kraft lost $1.5 million on NCE sales during 1987-1992, every 1 cent per pound reduction in NCE prices lowered Kraft's raw material procurement costs by over $10 million annually (NCE Report: 197).

Because NCE prices were generally lower than spot prices, this created an incentive for buyers to participate in NCE trading. However, for sellers, the NCE was nearly always an inferior outlet. The main reasons for firms to sell on the NCE appear to be either to influence NCE prices or to dispose of distress merchandise, neither of which are desirable as the economic foundations of the selling side of a market.

V. Why is the NCE Not a More Efficient Market?

For the 22-year period, 1974-1995, the volume traded on the Exchange never exceeded 0.67 percent of U. S. cheese production, was as low as 0.03 percent, and averaged 0.31 percent. Why the thinness and why so few participants? In the main, because the NCE is the least desirable of the alternative methods of selling cheese. The preferred method is long-term oral or written contract arrangements which account for 90 to 95 percent of total cheese. The price in these contracts is formula-priced off the NCE price. Contract sales arrangements have many advantages over either spot sales, the second most preferred method of selling cheese (5 to 10 percent of the total), or NCE sales.

Since foresight is never perfect, contract sales and purchases must be supplemented by the spot market in which prices are negotiated each week. The spot market has several advantages over the NCE: greater size and liquidity and usually higher prices. In addition, firms need not be concerned about moving the entire market price when they deal in the spot market. For example, the major sellers of bulk cheese off the Exchange are often reluctant to sell cheese on the NCE

because of the real possibility that such a sale will reduce the price they receive on their contract sales. Thus, the NCE is thin in large part because it is an inferior outlet for surplus cheese.

The rules of the NCE also discourage participation. West coast and eastern cheese manufacturers are unlikely to send a representative to Green Bay, Wisconsin, for 30 minutes of trading each Friday. They are also discouraged from participating because prices on the NCE are FOB within 200 miles of Green Bay. A west coast cheese manufacturer would have about 4 cents/lb deducted from the NCE price for freight regardless of the actual freight costs. As cheese manufacturing has become geographically more decentralized, a declining share of cheese production is convenient to Green Bay, Wisconsin.

Does arbitrage occur to prevent NCE prices from being manipulated substantially below the spot market price? An examination of trading by brokers, the most likely arbitrageur candidates, indicated that their trading was not motivated by arbitrage opportunities. Brokers, which accounted for 4.6 percent of all purchases on the NCE during 1988-1993, generally bought when the price differential between spot and NCE was relatively small, the reverse of what would be expected if arbitrage was being practiced.

Why do companies continue to use NCE prices for formula pricing? Why do not those who are injured use other pricing systems? The primary reason cheese companies and their customers use NCE prices for formula pricing is that the practice reduces transaction costs and ensures that buyers and sellers pay and receive the same price as their competitors. There currently is no viable alternative to the NCE for this purpose. This situation is not unique to the cheese industry. In many commodity markets, formula pricing is commonly used and strongly embraced even though questions abound regarding its efficiency (Marion 1986, p. 73; 101).

The continued use of a reference price like the NCE may primarily stem from industry

custom, the lack of better alternatives, and uncertainty by the industry regarding its adequacy as a reference price. The NCE has been used for formula pricing bulk cheese for decades. Although the NCE has been much criticized, until recently, there was no empirical evidence that NCE prices did not appropriately reflect national supply and demand. And, over the years, there have not been viable alternatives for formula pricing cheese.[11]

There is enormous inertia associated with prevailing formula pricing systems. Both buyers and sellers are accustomed to existing systems. Even if individual companies are dissatisfied with a reference price, they are unlikely to try to change unless several of the leading companies take the initiative. Finally, the leading trader on the NCE, Kraft, enjoys competitive advantages that prevent others from countering effectively practices that cause inefficient prices (Section VIII).

The benefits of market power on the NCE are realized not on the NCE itself, but in the much larger contract market in which prices are tied to the NCE. Thus, it is not like traditional markets where the achievement of monopoly rents in market A is likely to attract entry from market B of the same product, if entry barriers are low.

The perverse trading pattern on the NCE substantially reduced the chances that firms in the contract market will enter the NCE to take advantage of depressed prices on the NCE and thereby tend to correct abuses. Leading buyers in the contract market are the leading sellers on the NCE (Kraft, Borden, Alpine Lace), or are already leading buyers on the NCE (Beatrice, Schreiber). Thus, there are few major buyers in the contract market that are not already trading on the NCE. The leading firms trade on the NCE with an eye to how it affects their profits in the

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[11] Formula pricing in the beef industry provides a useful comparison. For decades, the Yellow Sheet (a trade market service) was used to formula price wholesale beef carcasses and primals. Only after a study revealed major shortcomings to the Yellow Sheet procedures was an alternative developed (USDA's "pink sheet"). With both buyers and sellers aware of the weaknesses of the Yellow Sheet and the availability of a superior alternative, the industry gradually shifted to the Pink Sheet for reference prices.

contract market. Strategic behavior is the norm, not the exception.

Economists often rely on the theory of efficient markets in evaluating the consistency of empirical observations with the predictions of economic theory. But theoretical predictions always depend on the assumptions of the underlying theory. Often the term efficient markets assumes that (1) traders do not have different comparative advantages in information acquisition, (2) traders are risk neutral, and (3) traders motivated by market arbitrage opportunities are sufficiently well financed (Le Roy, 1989).

These assumptions are not met among NCE traders. Market information is asymmetrically distributed among traders. Documents indicate that market leader Kraft believed its large size gave it a comparative advantage in acquiring market information, a belief apparently shared by other leading traders (Cheese Report: 167).

Cheese companies also appear to be risk averse, as is indicated by the widespread interest in an effective cheese futures market. Also, there is virtual universal use of NCE-based formula-pricing by cheese manufacturers and marketers, which guarantees that a cheese company will receive (or pay) the same price for bulk cheese as its rivals. Should a trader questioning the legitimacy of NCE prices decide to challenge Kraft's price leadership, the trader must assume the risk of failure as well as incur increased information acquisition costs.

Finally, those traders most likely to challenge the accuracy of NCE prices are weaker financially than Kraft, as reflected by the size of their cheese business and by their profit margins. All leading cheese manufacturers and marketers, except for those with strong brands, have small profit margins and operate in an environment of volatile prices, conditions that encourage risk aversion strategies. Competitors to Kraft that have strong brands tend to have similar interests to Kraft regarding NCE prices, and hence are unlikely to counter Kraft's selling pressure. Traders

without strong brands have more vulnerable profit margins, are more likely to want to avoid greater risk, and hence are unlikely to challenge Kraft's price leadership.

In sum, there are important asymmetries among NCE traders with respect to market information, risk and financial resources. The presence of these asymmetries suggests that the NCE will not generate efficient prices.

VI. Trading Conduct of Leading Traders

During 1988-1993, there was a cyclical pattern to cheese prices each year caused by seasonal variation in overall supply and demand conditions. Prices typically were lowest in January-March, the beginning of the flush production period, after which they rose until they peaked in late summer or fall. While overall supply and demand conditions determine the broad contour of prices over each price cycle, the high inelasticity of short-run supply and demand creates a range of market clearing prices at each point on the cycle. This gives traders with market power a range within which they may influence the price established each week on the NCE.

As noted above, leading cheese company traders may be divided into two groups based on their differing financial interests in the level of NCE prices. Kraft, Borden and Alpine Lace apparently benefit from lower NCE prices, whereas Beatrice, Mid-Am, Schreiber, Land O' Lakes and AMPI apparently benefit from higher NCE prices, other things remaining the same. Here we examine the trading conduct of Kraft to determine whether it is consistent with that expected of a dominant trader--i.e., to act as the leader in shaping the pattern of prices over each price cycle. Figure 3 displays Kraft's trading activity for the period July 1988 through June 1992.[12] The solid

[12] Because of space limitations, figures showing the trading patterns of other traders are not shown here. They appear in NCE Report, pp. 129-138.

Fig.3.a: Kraft Activity on the NCE

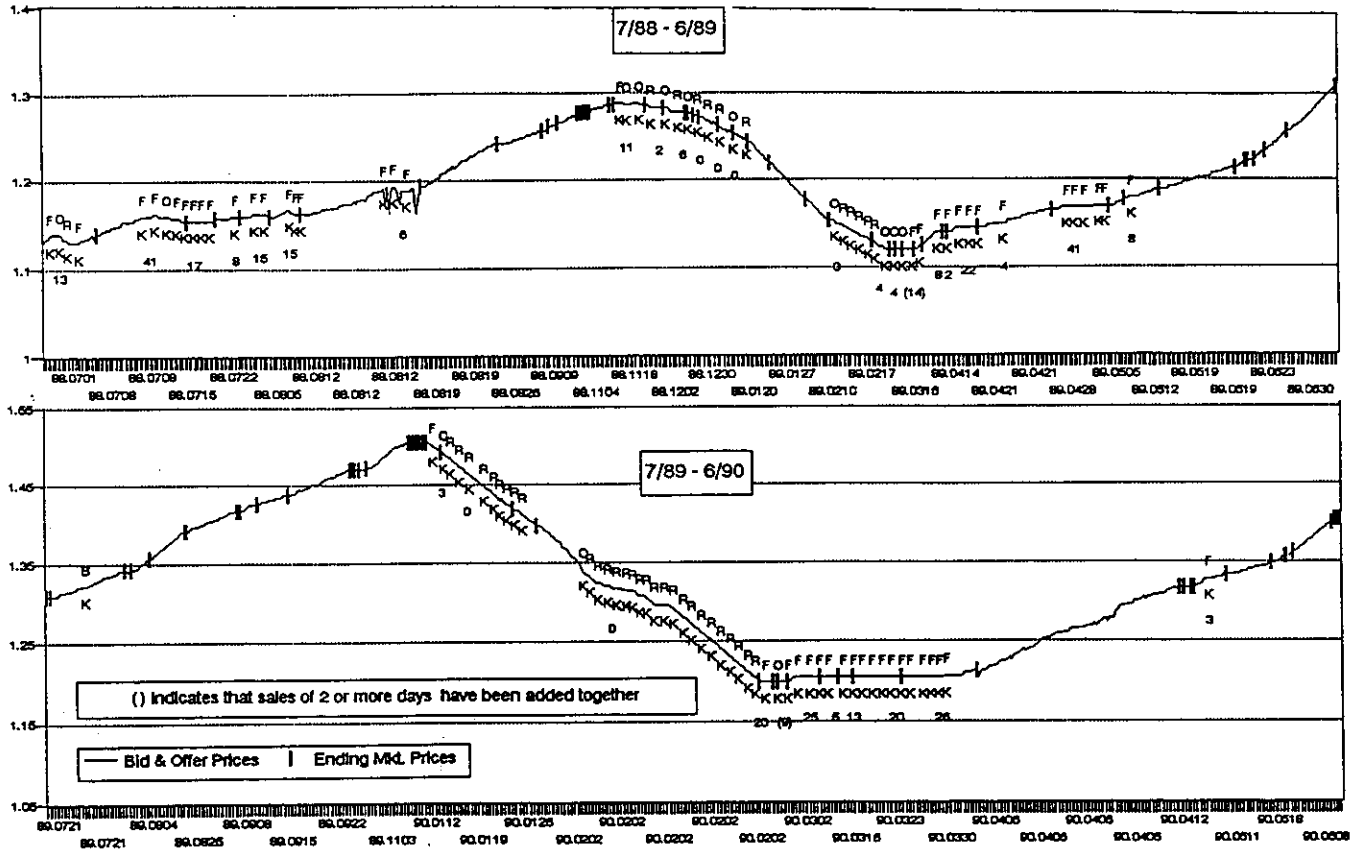
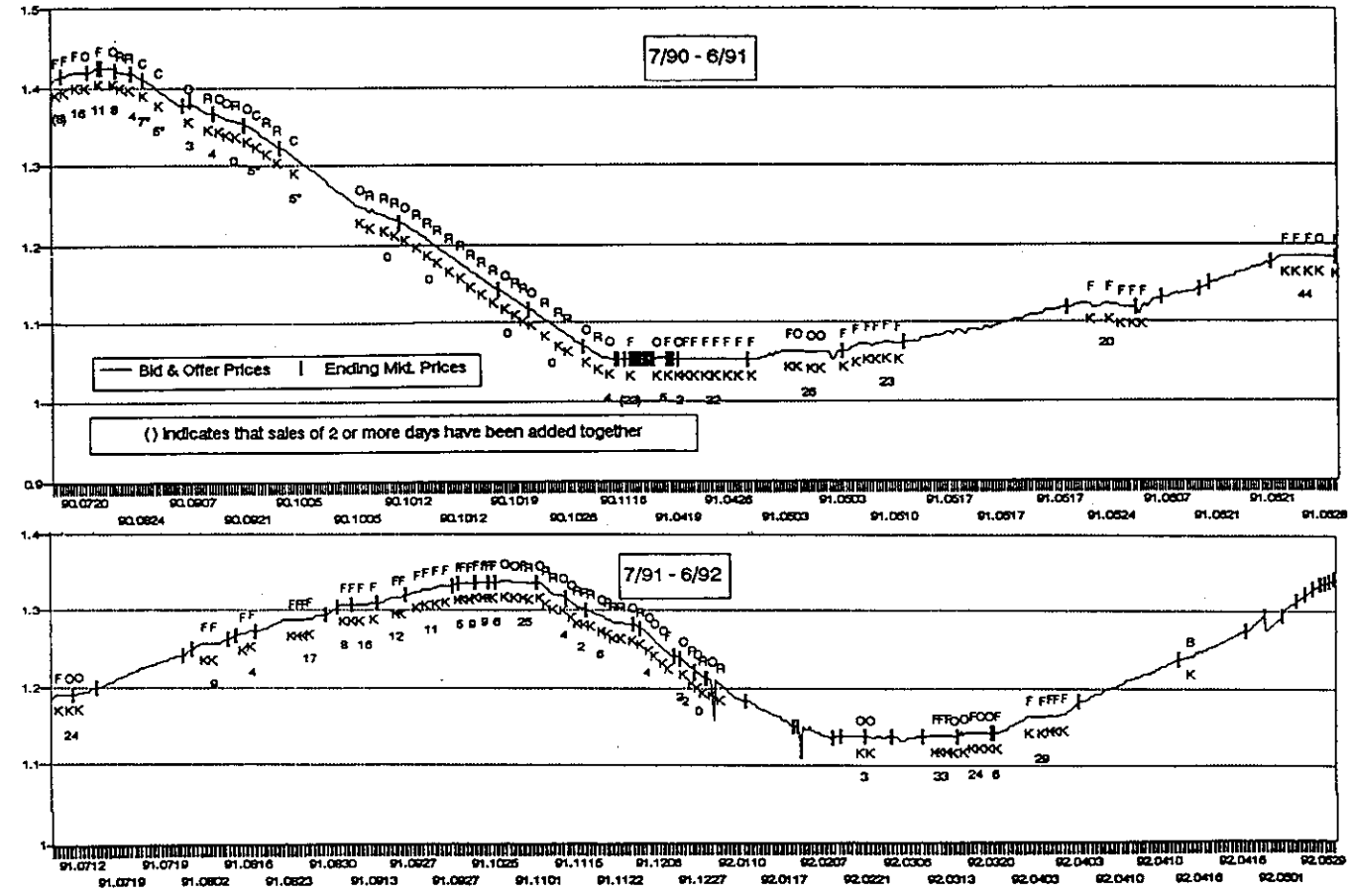


Fig.3.b: Kraft Activity on the NCE



vertical bars show the NCE settlement price for barrels[13] at the end of each trading day, and the space between bars identifies the extent of trading activity during the day. The "K" notation below the price line identifies each time Kraft acted on the NCE. The notations above the price line identify the types of activity involved as follows: F, Kraft filled another trader's bid to buy; O, Kraft offered to sell; R, Kraft reduced the price of its previous offer; C, another trader covered a Kraft offer to sell; and B, Kraft bid to buy. The numbers below the line indicate the number of loads Kraft sold. Below the bottom axis of each figure is shown trading dates with year, month, and day; e.g., 88.0701 is July 1, 1988. Not all trading dates are reported because of space limitations.

Over each price cycle, Kraft usually traded most actively at price tops, price declines, and price bottoms. At price bottoms, Kraft sometimes appeared to fill as many bids as required to keep prices at or near the seasonal low. Between a price bottom and the next price top, Kraft often remained inactive as buyer-traders bid up the market, often with few consummated sales. During periods of rising prices, Kraft appeared to signal implicit approval of rising prices by not participating in trading, occasionally signaled explicit approval of rising prices by submitting bids,[14] and at times signaled disapproval of rising prices by actively selling into a rising market,

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[13] To simplify the presentation, no price line is shown for blocks, which generally move in unison with barrel prices but at a small premium.

[14] For example, an April 16, 1992, internal company document of a leading buyer-trader stated: "A significant event occurred today. When the block market was bid to $1.27, Kraft entered a bid for four cars of blocks at $1.27 and 5 cars of barrels at $1.24/pound...*Kraft's message to the industry was that they were not going to sell any blocks or barrels at this point in time*" (Emphasis added; NCE Report: 110) Kraft's April 16, 1992, bid is shown on Figure 3.b. Kraft's expected conduct was confirmed by subsequent events: Kraft did not offer to sell on the NCE for the next 16 weeks, during which prices continued to rise.

thereby moderating upward price trends.[15] At price tops Kraft often initially filled bids with the effect of slowing or stopping the upward trend. Thereafter, Kraft led in filling bids and in offering to sell as the market topped and began to subside. Once a downward price trend was established, Kraft frequently continued making offers to sell--often joined by Borden and Alpine Lace and sometimes by other traders. Little actual selling was required to maintain a downward price trend. In sum, the apparent purpose and effect of Kraft trading strategy over a price cycle was to shape the pattern of the cycle by topping the market, triggering price declines, maintaining price bottoms, and moderating the rate of price increases.

The trading conduct of the two smaller seller-traders, Borden and Alpine Lace, differed from Kraft's in an important respect (NCE Report: 104-105). Whereas Borden made 30 percent of all offers to sell barrels during 1988-1993, it made only 4 percent of all barrel sales. Likewise, Alpine Lace made 30 percent of all offers to sell blocks but made only 5 percent of all block sales. The apparent explanation for these disparities in the pattern of offers and sales is that when buyer-traders began buying heavily, Borden and Alpine Lace generally became inactive, leaving Kraft to assume the losses that usually accompanied heavy selling.

Leading seller-traders were confronted by a small group of buyer-traders, led by Beatrice in barrels and Mid-Am in blocks. The buyer-traders were most active at price bottoms and during upward price trends. At price bottoms they exerted upward pressure on the market by covering offers or making bids. Whenever Kraft stopped filling bids at a price bottom, buyer-traders

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[15] For example, internal documents of a buyer-trader stated, in part:

June 14, 1991 Trading Session: "...Kraft seems to be taking the position that they will sell to prevent a panic market run up but will not stop an orderly market rise."

July 19, 1991 Trading Session: "The cheese available, especially barrels, continues light--with Kraft selective selling moderating the rise in markets."

October 8, 1991: "Kraft selective selling continues to moderate the upward movement." (NCE Report: 111)

See Figure 3.b. for Kraft's trading during this price rise.

actively bid up prices, usually with few or no sales--except when Kraft sold into the market for the apparent purpose and effect of moderating the rise. Compared to seller-traders, the buyer-traders apparently were a less cohesive group--with some selling when others were buying.

VII. Examination of Trade-Price Relationships

The preceding demonstrates that the conduct of leading traders was consistent with the motives hypothesized. The conflicting motives and conduct of the leading traders imply that NCE trading occurred within the context of bilateral oligopoly, where a dominant seller--with a couple followers--confronted a small group of buyer-traders. This raises the question, what was the relative impact on prices of the opposing traders? The preceding evidence indicates that the dominant seller held the upper hand. Here we perform an econometric test of the following hypotheses: (a) the trading activity of the leading seller-traders, dominated by Kraft, had a negative influence on NCE prices and (b) the trading activity of the leading buyer-traders had a positive influence on NCE prices.

The Economic Model

A simple competitive partial equilibrium model of the monthly pricing of cheese at the manufacturing level may be written as a function of dynamic adjustments, predetermined supply and demand shifters as follows:

$$P_t = f(\underline{p}_t^{\prime}, S_t, \underline{x}_t) \qquad t = 1,2\ldots T \qquad (1)$$

where denotes the monthly average price of cheese; vector $\underline{p}_t^{\prime}$ denotes lagged cheese prices; S_t denotes predetermined total supply;[16] and $\underline{x}_t$ is a vector of exogenous variables that are important

[16] A referee pointed out that treating supply as an independent variable in our monthly models might be inappropriate if monthly supply is actually determined endogenously. We tested for this possibility using the Hausman test. We could not reject the null hypothesis that supply was exogenous.

shifters of the demand for cheese (e.g., disposable income, population and seasonality). The subscript t indicates month t. Under the competitive model given by equation 1, lagged cheese prices are included to reflect the possibility that supply and demand conditions prior to any given month influence cheese prices for that month. Total supply in a given month is considered as predetermined because of short-run inelastic cheese supply response.

Observed prices, however, are affected by a complex interaction of market forces, government price support policies, and the conduct of leading traders on the NCE. The federal government directly influences cheese prices through the CCC purchases of cheese for school lunch and other purposes and, importantly, through price supports for milk used in manufacturing cheese. Under the price support program, the federal government buys cheese, butter, and dried skim milk to assure that the price paid to farmers for manufacturing grade milk does not fall below support levels. Federal price supports put a floor on the price of bulk cheese. Moreover, traders play an important part in setting the level of observed NCE cheese prices. Thus, the above competitive model of cheese pricing must be modified to account for both government intervention and the potential effect of leading NCE traders.

Econometric Model

Our econometric model includes the variables in equation 1 plus variables to account for the influence of leading NCE traders and government intervention. The effect of leading NCE traders' conduct on the level of observed prices can be accounted for by incorporating variables representing the trading activities of leading sellers and buyers on the NCE. The estimation problem caused by government intervention in the cheese market is dealt with using two alternative methods, as detailed below.

Government intervention has at times played a dominant role in determining prices, since

the CCC purchase price tends to set a lower bound on NCE prices. Thus when the NCE price drops to the CCC support level, market factors become of marginal importance. For example, during 1988-1993, 17 percent of monthly NCE prices were at or slightly below the CCC price support level. These observations pose a problem in specifying a model to explain cheese prices since price supports prevent NCE prices from going significantly below the CCC price.

One way to resolve the estimation problem created by CCC purchases is to employ a censor regression (Tobit) model (Maddala, 1983). Let P_t^g be the CCC purchase price for cheese in month t. In the Tobit Model a switching regression equation may be specified as in equation 2. P_t, $\underline{p}_t^{\ell}$, S_t^c. and x_t are as defined in equation 1, except that S_t^c is commercial supply rather than total supply. K_t and Bf_t are indices of the participation of leading sellers and buyers on the NCE.

$$P_t = \begin{cases} \alpha_0 + \underline{\beta}_1' \underline{p}_t^{\ell} + \beta_2 S_t^c + \beta_3' x_t + \beta_4 K_t + \beta_5 BF_t + u_t & \text{if } P_t > P_t^g \\ P_t^g & \text{otherwise,} \end{cases} \qquad t = 1,2\ldots T \quad (2)$$

The Tobit Model allows for switching between two regimes, i.e., the market regime and the government regime. The switching is conditional on the level of P_t relative to P_t^g. If the observed cheese price is greater than the CCC purchase price, observation P_t is treated as the market-determined price of cheese at time t; otherwise, it is equal to the CCC purchase price, P_t^g. S_t^c is commercial supply, which equals total supply minus net government purchases.[17] We assume the residuals, u_t, are independently and normally distributed with mean zero and common variance σ^2. A maximum likelihood estimation of the Tobit model would render consistent estimates of the

[17] This variable replacement allows for government intervention in cases where market price is above the CCC price, but where government cheese purchases under programs other than the price support program may still affect cheese prices.

parameters α_0, $\underline{\beta}_1$, β_2, $\underline{\beta}_3$, β_4, and β_5.

Another way to overcome the estimation problem caused by government intervention is to control for CCC net removal of cheese in each month, since it is through purchasing of cheese at CCC prices that the federal government implements its price policy. Thus if we employ the commercial supply of cheese, S_t^c, for each month in the following equation, we may have insulated cheese prices from the distortion caused by CCC purchase prices.

$$P_t = \alpha_0 + \underline{\beta}_1' \underline{p}_t^t + \beta_2 S_t^c + \underline{\beta}_3' \underline{x}_t + \beta_4 K_t + \beta_5 BF_t + e_t \qquad t = 1,2...T \quad (3)$$

A maximum likelihood estimation of equation 3 (referred to here as Full Sample Model) would allow us to use the full sample of observations without censoring any observations.

In the analysis that follows, we employ both the Tobit Model (equation 2) and the Full Sample Model (equation 3) to explain monthly NCE and barrel and block prices, the two types of bulk cheddar cheese sold on the NCE.

Variables, Data and Hypotheses

Dependent Variable

NCE Prices. Monthly NCE barrel and block prices are calculated as the simple averages of weekly NCE barrel and block prices as reported in *Dairy Market News*, USDA.[18] The producer price index (PPI) for processed food and feed (1982=100) is used to deflate nominal monthly prices.

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[18] Whereas NCE data are available weekly, only monthly data are available for supply and demand variables. We have expressed all variables in monthly values because the weekly values can be aggregated accurately to monthly values but monthly values cannot be converted accurately to weekly values, thus resulting in estimation errors that would bias the model's coefficients. Weekly models, while inferior for the above reasons, were also estimated using weekly NCE prices and trader activity variables, monthly supply and demand variables and six weekly lags. The results were very similar to the monthly models. Indeed, the t-values on the coefficients for the trader activity variables are somewhat larger in the weekly models.

Independent Variables

Lag Prices (Lag 1 and Lag 2). For each dependent variable, we use monthly prices lagged by one and two months, respectively, as independent variables.[19] Lagged prices are introduced to account for the lagged or dynamic adjustment mechanism of monthly cheese prices. The coefficients for these variables reflect the speed of adjustment or delayed effect of other independent variables on the current monthly price. In other words the effect of other independent variables is the sum of the short-run or simultaneous effect and the delayed effect.

Supply (S^c). Supply is measured by per capita monthly commercial supply of American cheese in pounds. Commercial supply is equal to total supply minus CCC purchases during the month. Total supply is defined as the monthly production of American style cheese, plus beginning-of-month commercial stocks, plus CCC sales for unrestricted use in commercial channels. The CCC sales in commercial channels are included because they affect market price by adding to the existing market supply. Monthly population estimates were used to arrive at the per capita commercial supply of cheese. Per capita monthly commercial supply figures in each year were standardized into 12 equal periods to adjust for differences in the number of days in each calendar month. We expect the per capita commercial supply of cheese to be negatively related to NCE prices.

Demand Shifter (D). Monthly real per capita disposable personal income in thousands of 1982 dollars, D, is employed to account for one source of shifts in demand. Nominal disposable personal income (as reported in *Survey of Current Business*, Economic and Statistics Administration, Bureau of Economic Analysis, US Department of Commerce) was deflated using

[19] We also examined three and four month lagged prices and found no significant effect on current prices. We conclude that one and two month lags are the most appropriate lags for prices to adjust to the changes in independent factors.

an implicit price deflator for personal consumption expenditure to arrive at real disposable income. Monthly population estimates were used to get per capita income figures. We expect D to be positively related to NCE prices.

Seasonality (M2,...M12). Eleven monthly dummies, one for each month from February (M2) to December (M12) are employed to control for the effect of demand seasonality on NCE prices. Demand seasonality results from changes in consumer demand and the building up and the drawing down of inventory. January is excluded for dummy variable purposes.

Trader Activity Categories (K, K-Group, and BF-Group). Modeling trader activity is difficult because the strategies employed varied, depending on the response of other traders. As shown in Figure 3, Kraft sometimes sold large quantities in order to maintain a market bottom (see for example February-March 1990, April-May 1991, and March-April 1992). At other times, Kraft was able to influence the market by offering a few carloads or by simply signaling its intentions. The action required of Kraft depended on the strategic response of others. Thus, in modeling the effects of Kraft's trading, the essence of the matter is whether or not Kraft was active on the NCE on a particular day, not how much it sold, or offered to sell. *Thus, we hypothesize that if Kraft was active on the NCE, it was pursuing strategies designed to influence prices in ways beneficial to it.* We use the same measure of trader activity for the other leading traders. Because Borden and Alpine Lace have interests in common with Kraft and often trade on the same day as Kraft, their activity is combined with Kraft's to form the K-Group variable. The BF-Group variable measures the participation of the leading five buyer-traders: Beatrice, Mid-Am, Schreiber, Land O' Lakes, and AMPI. Although this measure may not capture all the nuances of strategic trading, it is consistent with considerable factual evidence of trader motives and conduct.

The degree of participation in trading activity during a month is measured by the percent of trading sessions each month in which at least one member of the group is active on the Exchange. Because the number of trading sessions in a month is either 4 or 5, this variable may take on the following values for each group: 0, 20%, 25%, 40%, 50%, 60%, 75%, 80%, or 100%.

The K and the K-Group variable are expected to be negatively related to NCE prices, and the BF-Group variable is expected to be positively related to NCE prices.

Estimation and Results

Appendix Table 1 presents the maximum likelihood estimates of monthly NCE barrel prices for the Tobit and Full Sample Models for 1988-1993 (equations for block cheese in Report, Appendix Table 5.6). The two models yield very similar results, perhaps reflecting the fact that only 17 percent of the price observations were at or below the CCC support level.

Estimated coefficients for Lag1 and Lag2 are statistically significant at the 1 percent level in both the Tobit and Full Sample Models. Overall, the significant coefficients for Lag1 and Lag2 suggest that it takes three months for NCE prices to adjust fully to changes in the independent variables.

As expected, the coefficients for S^e and D are negative and positive, respectively, in each of the estimated equations for both the Tobit and Full Sample Models. The coefficients on both variables are statistically significant at the 1 percent level in all equations.

The effect of seasonality as depicted by the coefficients for $M_2, M_3 \ldots M_{12}$ in the four equations implies that on average, prices bottom in February and peak during July, August and September. Low prices in February reflect low demand for commercial stocks in addition to low demand for consumption after the holiday season of December and January; high prices during

July through September, in contrast, reflect high demand for commercial inventories and high demand for consumption with the start of school.

To facilitate presentation, the coefficients and t-values of the trader activity variables as reported are summarized in Table 1. When the Kraft trader activity variable, K, is included in the two models, the estimated coefficients on K are significantly negative at the 5 percent level. Replacing K with K-Group in the two models somewhat increases the magnitude and the significance of the estimated coefficients. This suggests that while Kraft was predominantly responsible for the size of the coefficient on K-group, the participation of the other two leading seller-traders may have contributed modestly to Kraft's impact on prices.

When both the K-Group and BF-Group are included in the equations, the estimated coefficients for the K-Group in the Tobit Model and Full Sample Model are statistically significant at the 5 percent level. Though positive as hypothesized, the estimated coefficients for the BF-Group (leading buyer-traders) are very small and are not statistically significant in any of the equations.

These findings support the hypothesis that the trading activity of the leading seller-traders, dominated by Kraft, had a significant negative impact on NCE cheese prices. On the other hand, the activity of the B-group of leading buyers had no statistically significant impact on prices. Holding other variables constant, the findings imply that when at least one of the leading seller-traders was active in each trading session during a month, NCE prices were lower by 3.2-3.6 cents per pound for barrel cheese and 3.3-3.5 cents per pound for block cheese, respectively, than when none of the leading sellers was active. These are the effects of current month trading on current month prices expressed in 1982 dollars. The cumulative or dynamic consequences of trader activity must also consider the lagged effects. Whereas the Tobit Model indicates current

Table 1. Estimated Relationship Between Trader Activity Variables and Monthly NCE Prices, 1988-1993 (n=72)

	Tobit Model			Full Sample Model		
			BARRELS			
Equation	1a	1b	1c	2a	2b	2c
K	-0.026[b] (2.17)	--	--	-0.025[b] (1.96)	--	--
K-Group	--	-0.026[b] (2.06)	-0.032[b] (2.13)	--	-0.028[b] (2.14)	-0.036[b] (2.40)
BF-Group	--	--	0.013 (0.73)	--	--	0.018 (1.08)
			BLOCKS			
Equation	3a	3b	3c	4a	4b	4c
K	-0.021[b] (2.03)	--		-0.026[b] (2.37)	--	--
K-Group	--	-0.029[a] (2.68)	-0.033[a] (2.54)	--	-0.031[a] (2.79)	-0.035[a] (2.54)
BF-Group	--	--	0.008 (0.51)	--	--	0.007 (0.46)

Source: The value of other variables used in these equations appear in NCE Report Appendix Tables 5.5 and 5.6.

Note: A one-tail t-test is used to determine statistical significance. An *a* denotes 1% level of significance and a *b* denotes 5% level of significance.

month price depression on barrels of 3.2 cents per pound when seller traders are active, the cumulative impact is approximately 7.2 cents per pound in 1982 dollars and 9.0 cents in 1993 dollars.[20]

VIII. The Sources of Kraft's Market Power

The above examination of trading conduct identifies Kraft as the price leader in NCE trading, and econometric and documentary evidence indicates that it has influenced NCE prices to its advantage. This raises the question, what kind of price leader was Kraft? Identifying someone as a price leader is only a beginning, since all price leaders are not alike. Conceptually, the performance outcomes of price leadership range from the *dominant firm price leader* at one extreme and the *competitive barometric price leader* at the other (Bain, Markham, Scherer and Ross, and Stigler).

A *dominant firm price leader* sets a profit maximizing price, which is passively followed by the competitive fringe. The distinctive feature of a barometric price leader is that it promptly reflects changes in aggregate supply and demand conditions. The *competitive barometric price leader commands* the adherence of others because it promptly sets prices reflecting market changes "that would eventually be set by forces of competition." Such leaders are most often found in industries with moderate concentration and entry barriers, and that exhibit competitive conduct, e.g., periodic changes in the identity of the price leader.

Whereas the competitive barometric price leader is innocuous, not so the *monopolistic*

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[20] Bulk cheese bought under long-term contracts is formula priced off NCE prices, typically at a small premium. As a result, transaction prices are not identical to NCE prices. To determine whether this potential shortcoming of NCE prices significantly affected the relevance of our results, we re-ran the two models using WAP prices, which are prices paid on spot sales at Wisconsin Assembly Points. The results using WAP prices are very similar to those using NCE prices (NCE Report, Appendix Tables 5.7 and 5.8.) Since WAP premiums over NCE vary more frequently and by larger amounts than do the premiums of committed supply agreements, the use of WAP prices may provide a conservative test of whether our models accurately reflect changes in actual transaction prices of committed supply agreements.

barometric price leader, which not only adjusts prices to reflect changing aggregate market conditions but also enjoys significant discretion in doing so; this enables it to shape the pattern of prices in ways favorable to it. Such discretion is greatest in markets with high concentration, significant entry barriers, a homogeneous product, and an inelastic demand and/or supply.

Kraft's price leadership most closely matches that of a barometric price leader that enjoys a significant degree of discretion in shaping the pattern of prices over a price cycle. Kraft enjoys such discretion because all the structural conditions necessary for an effective monopolistic barometric price leader are present in NCE trading. In addition, several NCE trading rules and practices facilitate such price leadership.[21] We examine each of the structural conditions below.

High Market Concentration

The average seller HHI (Herfindahl-Hirschman Index)[22] on the NCE was 5990 and the average buyer HHI was 2729 during 1988-1993 (NCE Report: 43). Both HHIs were well above the threshold of 1800 the Department of Justice uses in identifying "highly concentrated" markets predisposed to noncompetitive behavior, either by a dominant firm or by tacit or explicit cooperation among firms.

Kraft made about 75 percent of all NCE sales, on average, and together with its two fellow seller-traders made 82 percent of all sales during 1988-1993. Kraft made 83 percent of all barrel cheese sales on the NCE, which account for 68 percent of all NCE sales during 1988-1993.

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[21] During 1988-1993, NCE trading rules specified centralized trading (Green Bay), a homogeneous product, transparency of trading (i.e., the posting of all offers, bids, and trades by name of trader), and a single basing point (Green Bay) for calculating freight differentials regardless of actual distance shipped. These rules facilitate price leadership and price coordination in oligopolistic markets. Although all Exchange members were free to trade on the NCE, the basing point rule effectively excluded selling by cheese companies located on the west and east coasts. NCE rules required a seller to pay the freight cost from its plant to Green Bay irrespective of the buyer's location. Hence, a California seller would pay a freight cost of about 4 cents/lb, even if the buyer is located in California. The NCE modified this rule following the release of the NCE Report.

[22] The Herfindahl-Hirschman Index is the sum of the squares of individual firm market shares.

Kraft uses about 35 to 40 percent of the nation's barrel cheese, which is used in making processed cheeses and cheese spreads, and Kraft made about 60 percent of all *retail* sales of processed cheeses (NCE Report: 201).

Barriers to Entry

The major barriers confronting traders are several competitive advantages held by Kraft that other traders cannot replicate at the same cost. These advantages emanate from Kraft's large size and organizational structure. Kraft is the nation's largest cheese company, a large cheese manufacturer,[23] the largest *buyer* of bulk cheese, the leading *seller* on the NCE, and the leading marketer of processed, natural and cream cheese to food retailers.[24]

Kraft's large size in the cheese industry and in NCE trading give it several *strategic competitive advantages* over actual traders and potential traders, i.e., the ability to influence the actions of rivals in ways favorable to Kraft. One advantage derives from Kraft's position as the largest buyer of bulk cheese off the NCE as well as a large cheese manufacturer.[25] Each year Kraft builds some surplus into its purchases from committed suppliers. Because Kraft generally contracts for the entire output of specific plants, this gives it control over the disposal of these supplies. Were the decision left to suppliers, they generally would sell "surplus" cheese in the

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[23] During 1988-1993, Kraft manufactured about 40 percent of its cheese requirements, excluding cream cheese, and bought the rest from committed suppliers and in the spot market.

[24] In 1990, Kraft sales to retailers had a retail value of nearly $3 billion and accounted for the following shares of retail cheese sales: cream cheese, 75 percent; processed cheeses, 58 percent; and natural cheese, 30 percent (NCE Report: 159).

[25] In an interview, the Chairman-CEO of Kraft General Foods, Inc., reportedly said size "yields a lot of areas of *competitive advantage*" including "*incredible purchasing power*. Those types of advantages are very, very real" (Liesse and Dagnoli, 1992).

An internal Kraft *Cheese Procurement Strategy* document included among the implications of being the largest cheese buyer the ability to get better information than others about overall market conditions, and included among the strategies to maximize profits: developing superior information systems; establishing inventory strategic reserves; and influencing industry conditions to support Kraft business strategy (NCE Report: 201, note 5).

spot market, since selling in the thinly traded NCE may lower the prices received from NCE-based formula priced contract sales.[26] This control over supply gives Kraft considerable flexibility over the amount of cheese available to it for sale on the NCE. Hence, whereas Kraft about 75 percent of all NCE sales during 1988-1993, it likely could have made even more sales had this been in its interest.

Leading buyer-traders on the NCE have neither the flexibility in trading nor the strength of incentives of Kraft. Such companies may plan each year to buy some cheese in the spot market and on the NCE. But they rely predominantly on cheese procured under committed supply arrangements, which limits the amount they can buy on the NCE in any given week. Similarly, the agricultural manufacturing cooperatives that became buyer-traders in response to Kraft's selling on the NCE have mixed incentives since they must ultimately sell elsewhere any cheese purchased on the NCE that exceeds their needs. And, although the various buyers on the NCE appear to benefit modestly from higher NCE prices, Kraft and other branded marketers enjoy greater benefits from lower NCE prices.

Kraft enjoys another advantage over buyer-traders because of the *asymmetry in market information* among traders, an important source of strategic advantage that can confer market power and facilitate collusion (Encaoua, Geroski and Jacquemin, 1986; Feinstein, Block and Nold, 1985).[27] According to an internal *Cheese Procurement Strategy* document, Kraft believed that its greater overall size and larger committed supplier base gave it superior information regarding the size of industry inventories and overall supply/demand conditions (NCE Report:

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[26] Kraft gains additional control over the amount of cheese available for sale on the NCE because some committed suppliers have "balancing" plants that can switch between block and barrel output (NCE Report: 201, note 6).

[27] The British Office of Fair Trading found that "asymmetries in information" constituted a significant barrier to entry (Utton, 1995).

167). Other traders acknowledge that Kraft's superior market knowledge may discourage them from challenging Kraft's view of market conditions as implied by its trading conduct, especially during the turning points at the bottoms and tops of price cycles. When Kraft is active in a falling market, traders with *coincident* interests--especially Borden and Alpine Lace--often join in offering cheese. Traders with *conflicting* interests may remain on the sidelines, suspecting that Kraft knows better than they such relevant facts as the size of industry inventories and shifts in aggregate supply and demand. Other traders will hesitate in acting contrary to Kraft if they believe doing so involves greater risk than going along with Kraft. Such followership is reinforced by the fact that other traders have much slimmer profit margins than Kraft. The end result of Kraft's history of success in driving NCE prices gives it a *reputation* that encourages followership. The deference shown Kraft because of its superior market knowledge is a classic example of strategic advantage conferred by asymmetric market information, a great enemy of an efficient market (Le Roy, 1987).

Finally, Kraft gains competitive advantage because it buys so much cheese off the NCE directly from important actual and potential traders, a fact that may explain why leading suppliers of Kraft almost universally have elected not to participate in trading. Only one (AMPI) of Kraft's leading suppliers during 1991-1992 traded on the NCE in those years, suggesting that others were reluctant or unable to challenge Kraft on the NCE even though their interest in NCE price levels may have differed from Kraft's. AMPI, Kraft's leading supplier, also has traded less on the NCE than its size and interests imply.[28]

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[28] As with other cooperative cheese manufacturers, AMPI members benefit from higher NCE prices. Yet, during 1988-1993, it made far fewer purchases on the NCE than did Mid-Am or Land O' Lakes, the nation's second and third largest cheese cooperatives in those years. And on one occasion AMPI sold heavily on the NCE, in a disguised trade through a broker, causing a historic drop in prices (NCE Report: 143-144). AMPI apparently did not have a surplus at the time. It is conceivable, although unproven, that AMPI was selling in Kraft's behalf; Kraft did not sell barrels that week but did sell blocks.

Kraft's various competitive advantages forestalled others from effectively contesting its price leadership which established the NCE as a separate market from the larger aggregate market that formula priced off the NCE.[29]

Product Homogeneity

Effective price leadership is easier with a homogeneous product. This condition is met by trading rules that specify in detail the characteristics of the cheese traded.

Elasticity of Supply and Demand for Bulk Cheese

These elasticities are relevant in answering the question, to what extent are prices established on the NCE 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, provides 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 (NCE Report: 34). This range is especially large over short periods because bulk cheese output is highly inelastic in the short run. Even the longer term demand for cheese, butter, and non-fat dry milk is

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[29] Although all NCE traders operated in the aggregate market, few of those in the aggregate market traded on the NCE. Indeed, the same five leading seller-traders and five leading buyer-traders made 95 percent of all NCE sales and purchases during 1980-1995.

highly inelastic.[30]

During 1988-1993 the NCE had all the conditions necessary for the exercise of monopolistic barometric price leadership: very high seller concentration in trading; high entry barriers; a homogenous product; and the commodity traded had a highly inelastic demand and supply. These characteristics gave Kraft significant discretion in shaping to its advantage the pattern of prices over each price cycle.

IX. Concluding Comments

Kraft's potential influence over industrywide prices would be greatly diminished if it only *bought* from committed and spot suppliers and *sold* any surpluses only in the spot market; then Kraft's influence over price would be limited primarily to its buying power in the aggregate cheese market. Thus, the existence of the NCE and the industrywide practice of NCE-based formula pricing greatly enhances the use of the power conferred by Kraft's various strategic advantages in NCE trading. Absent the NCE, Kraft's market power would be limited to control over purchases in the aggregate market, where it holds a smaller share in a moderately concentrated oligopoly.

As currently organized, the NCE appears to facilitate market manipulation. The main beneficiaries of this situation appear to be Kraft and other seller-traders with coincident interests. The evidence supports the hypothesis that during 1988-1993 Kraft had (a) a financial *motive* for influencing NCE prices, (b) the *power* to influence prices, and (c) at times exercised this power for its benefit.

Because these conclusions are based on an analysis of the six-year period, 1988-1993, they may reflect factors *unique* to these years and, therefore, may be an imperfect predictor of the

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[30] According to Pagoulatos and Sorensen (1985), the price elasticity of demand at retail for cheese is -0.58, for butter -0.4 and for evaporated and dry milk -0.26. Since these estimates are for demand at retail, the elasticity of the derived demand facing manufacturers of these products is considerably less.

future performance of NCE pricing. There is evidence that its parent, Philip Morris, directed Kraft to increase substantially its earnings beginning in 1990. Kraft apparently responded by engaging in especially aggressive short-run profit maximization, as it substantially increased gross profits for cheese by widening the spread between wholesale net selling prices and bulk cheese procurement costs (Cheese Report: 159-167). During this period Kraft appears to have used the competitive advantages it enjoys in NCE trading to periodically depress bulk cheese prices, perhaps by a greater amount than is sustainable in the future. However, this does not diminish the apparent consequences of Kraft's conduct during the years studied, nor does it gainsay the need to enhance the NCE's competitive performance. Even short-run price manipulation subverts the market to the detriment of consumers and farmers as well as some industry participants.

References

Bain, Joe S. (1960) "Price Leaders, Barometers, and Kinks," *Journal of Business*, 33:193-203.

Caves, R. E. (1979) "Industrial Organization and the Problem of Thin Markets," in M. L. Hayenga (ed.)

Department of Justice (1992) *Horizontal Merger Guidelines*, Washington, D.C.

Encaoua, D., P. Geroski, A. Jacquemin (1987) "Strategic Competition and the Persistence of Dominant Firms" in J. Stiglitz and G.F. Matthewson, eds. *New Developments in the Analysis of Market Structure*. Cambridge: MIT Press.

Feinstein, J.S., M. F. Block and F. C. Nold (1985) "Asymmetric Information and Collusive Behavior in Auction Markets", *American Economic Review*, 34, pp. 441-460.

Geffen, R. J. (1951) "Antitrust Law in Wisconsin," *Wisconsin Law Review*, 1951, pp. 681-700.

Geroski, P. A. (1987) "Do Dominant Firms Decline?" in D. Day and J. Vickers eds, *The Economics of Market Dominance*. New York: Basil Blackwell.

Hayenga, M. L. (1979) "The Concept of a Thin Market," in M. L. Hayenga (ed.) *Pricing Problems in the Food Industry With Emphasis on Thin Markets*. Research Division, College of Agricultural and Life Sciences, University of Wisconsin-Madison.

Le Roy, S. F. (1989) "Efficient Capital Markets and Martingales," *Journal of Economic Literature*, 27, pp. 1583-1621.

Maddela, G. S. (1983) *Limited Dependent and Qualitative Variables in Econometrics*, Econometric Society Monograph, Cambridge, England.

Marion, B. W. and NC117 Committee (1986). *The Organization and Performance of the U. S. Food System*. Lexington, MA: Lexington Books.

Markham, J. W. (1951) "The Nature and Significance of Price Leadership," *American Economic Review*, 41, pp. 891-905.

Mueller, W. F., B. W. Marion, M. Sial, and F. E. Geithman (1996) *Cheese Pricing: A Study of the National Cheese Exchange*. Food System Research Group, Department of Agricultural

Economics, University of Wisconsin-Madison.

Nicholls, W. H. (1939) *Post-War Development in the Marketing of Cheese*. Iowa State College, Research Bulletin 261.

Nicholls, W. H. (1941) *Imperfect Competition with Agricultural Industries*. Iowa State College Press, Ames, Iowa.

Pagoulatos, E. and R. Sorensen (1986) "What Determines the Elasticity of Industry Demand," *International Journal of Industrial Organization*, 4, pp. 238-250.

Porter, M. E. (1985) *Competitive Advantage*. New York: The Free Press.

Raikes, R. (1979) "Thin Markets: Some Causes, Consequences, and Remedies," in M. L. Hayenga ed.

Scherer, F. M. and D. Ross (1990) *Industrial Market Structure and Economics Performance*. Boston: Houghton Mifflin Co.

Schrader, L. (1985) "Pricing and Vertical Coordination in the Food System," in B. W. Marion and NC117 Committee. *The Organization and Performance of the U. S. Food System*. Lexington: Lexington Books.

Stigler, G. J. (1947) "The Kinky Oligopoly Demand Curve and Rigid Prices," *Journal of Political Economy*, 55, pp. 444-446.

Utton, M. A. (1995) *Market Dominance and Antitrust Policy*. Brookfield, Vermont: Edward Elgar Publishing Limited.

Appendix Table 1. Estimates of Factors Affecting Monthly NCE Barrel Prices, 1988-1993
n=72

	Tobit Equations			Full Sample Equations		
	1a	1b	1c	2a	2b	2c
Variables	Coefficients					
Constant	-63.355[b]	-57.499[c]	-56.661[c]	-19.410	-17.682	-12.054
	(2.15)	(1.95)	(1.91)	(0.76)	(0.75)	(0.51)
Lag1	0.942[a]	0.942[a]	0.930[a]	0.985[a]	1.024[a]	1.031[a]
	(8.77)	(8.77)	(8.57)	(8.91)	(9.59)	(9.76)
Lag2	-0.385[a]	-0.392[a]	-0.376[a]	-0.416[a]	-0.440[a]	-0.433[a]
	(3.86)	(3.95)	(3.71)	(4.04)	(4.43)	(4.34)
S[c]	-25.816[a]	-26.124[a]	-25.761[a]	-22.243[a]	-21.654[a]	-20.345[a]
	(5.50)	(5.60)	(5.44)	(4.44)	(4.61)	(4.36)
D	13.630[a]	13.366[a]	13.169[a]	9.241[a]	8.968[a]	8.092[a]
	(4.38)	(4.28)	(4.15)	(3.29)	(3.40)	(3.05)
M2	-2.058	-2.769	-3.124	-1.092	-1.363	-1.583
	(0.99)	(1.37)	(1.50)	(0.55)	(0.67)	(0.76)
M3	4.435[b]	3.190	2.673	3.514[c]	2.798	2.404
	(2.09)	(1.55)	(1.23)	(1.74)	(1.40)	(1.18)
M4	8.781[a]	7.491[a]	7.053[a]	6.823[a]	5.961[a]	5.578[b]
	(4.15)	(3.57)	(3.22)	(3.34)	(2.92)	(2.69)
M5	6.319[a]	5.127[b]	4.497[c]	4.503[b]	3.393	2.552
	(2.80)	(2.29)	(1.87)	(2.03)	(1.54)	(1.11)
M6	9.007[a]	7.831[a]	7.249[a]	6.983[a]	5.908[b]	5.005[b]
	(4.05)	(3.47)	(3.03)	(3.12)	(2.65)	(2.14)
M7	11.243[a]	10.042[a]	9.367[a]	9.110[a]	8.105[a]	7.120[a]
	(5.21)	(4.75)	(4.11)	(4.08)	(3.69)	(3.05)
M8	10.986[a]	10.161[a]	9.638[a]	8.939[a]	8.301[a]	7.493[a]
	(5.10)	(4.87)	(4.39)	(4.00)	(3.79)	(3.29)
M9	11.656[a]	10.559[a]	9.987[a]	9.677[a]	8.769[a]	7.902[a]
	(5.49)	(5.17)	(4.59)	(4.40)	(4.09)	(3.51)
M10	5.545[b]	4.173[b]	3.863[c]	3.834[c]	2.599	2.119
	(2.65)	(2.08)	(1.89)	(1.76)	(1.23)	(0.99)
M11	5.934[a]	4.650[b]	4.263[b]	4.761[b]	3.829[c]	3.391[c]
	(3.02)	(2.47)	(2.19)	(2.37)	(1.94)	(1.69)
M12	2.267	0.993	0.962	1.403	0.434	0.537
	(1.15)	(0.53)	(0.51)	(0.69)	(0.21)	(0.26)
K	-0.026[b]	–	–	-0.025[b]	–	–
	(2.17)			(1.96)		
K-group	–	-0.026[b]	-0.032[b]	–	-0.028[b]	-0.036[b]
		(2.06)	(2.13)		(2.14)	(2.40)
BF-group	–	–	0.013	–	–	0.018
			(0.73)			(1.08)
R^2	0.924	0.924	0.924	0.907	0.907	0.908

Source: NCE Report, 1996.

Note: Maximum Likelihood methods are used to estimate both the Tobit and Full Sample models. A one tail test is applied to determine statistical significance on S^c, D, K, K-group and BF-group coefficients while a two tail test is applied for the rest of the coefficients. T-statistics are in parentheses: a/ denotes 1% level of significance; b/ denotes 5% level of significance; and c/ denotes 10% level of significance.

R^2 statistics are the squares of correlation coefficients between actual and predicted values.