PRICE-MARGIN MOVEMENTS IN THE FLUID MILK INDUSTRY

Robert L. Beck and Loys L. Mather

INTRODUCTION

Accelerating food prices during the past few years have focused renewed attention on the food marketing system. In particular, concern has been expressed regarding increased costs of food marketing. Producers and consumers alike tend to point an accusing finger at the marketing system for extracting an undue portion of the food dollar.

As evidenced by activities of various consumer groups, the milk marketing system has not escaped this scrutiny. Recent research efforts have centered around attempts to evaluate the system's efficiency. In short, concerns are usually expressed in terms of trying to understand or evaluate pricing behavior and market performance.

Increasing support levels for manufacturing grade milk in 1966 (76 cents above the 1965 level) marked the beginning of a period of increasing milk prices throughout the industry. This contrasted sharply with the prior decade, which was characterized by relatively stable milk prices (Table 1).

Since 1965, the price of manufacturing grade milk at farm level has more than doubled. Because of the close relationship between fluid and manufacturing milk prices, the price of milk eligible for fluid use has likewise increased at an unprecedented rate. Thus, the retail price has climbed steadily.

Consumption patterns for fluid milk changed noticeably during the same period. Sales of lowfat and skim milk items increased appreciably, while there was a shift away from whole milk consumption. For example, in July 1974, lowfat and skim milk items accounted for 28.2 percent of total sales in all federal milk order markets compared to only 9.7 percent in July 1962. Much of this increase is attributed to increased sales of lowfat milk alone. Lowfat milk sales in all federal order markets accounted for 19.5 percent of total sales and 69.1 percent of lowfat and skim milk items in 1974, compared to 2.3 percent and 24.0 percent, respectively, in 1962. Similar shifts were observed in the specific markets included in this study (Table 2).

During the period under study, per capita consumption of plain whole milk declined from 240.8

TABLE 1. PRICES RECEIVED BY FARMERS FOR FLUID AND MANUFACTURING MILK, KENTUCKY, AND U.S. PRICE SUPPORT LEVELS, 1955-74

Year	Fluid Milk	Manufacturing Milk	Support Price Level
	----------Average Prices----------		
1955	$4.35	$3.25	$3.15
1956	4.45	3.35	3.15-3.25
1957	4.45	3.30	3.25
1958	4.41	3.32	3.06
1959	4.40	3.33	3.06
1960	4.51	3.36	3.06-3.22-3.40
1961	4.43	3.39	3.40
1962	4.34	3.27	3.11
1963	4.48	3.29	3.14
1964	4.48	3.32	3.15
1965	4.54	3.34	3.24-3.50-4.00
1966	5.30	3.90	4.00
1967	5.52	4.05	4.28
1968	5.74	4.08	4.28
1969	5.86	4.19	4.28
1970	6.05	4.38	4.66
1971	6.11	4.47	4.93
1972	6.38	4.58	4.93
1973	7.37	5.73	5.29-5.61
1974	8.56	7.04	6.57

SOURCES: USDA, SRS, *Agricultural Prices*, Annual Summaries; USDA, ERS, *Dairy Situation*, DS-350, May 1974.

Robert L. Beck and Loys L. Mather are Associate Professors of Agricultural Economics, University of Kentucky, Lexington, Kentucky.

pounds to 176.7 pounds while per capita consumption of lowfat and skim milk increased from 16.3 pounds to 61.0 pounds [7].

BEHAVIOR OF MARKETING MARGINS: THEORY

An often-expressed concern is how do marketing margins behave during extended periods of rising or declining prices? More specifically, what is the relationship between farm prices and market margins? In assessing market margins for milk there is little theoretical basis for postulating the relationship between farm price and market margins. Two behavioral aspects of margin determination, however, are discussed in the literature by Thomsen and Foote [6], Rojko [5], Myers, Havlicek and Henderson [4] and George and King [1]. These behavioral practices usually result in margins being determined either on an absolute (cost per unit) or on a percentage markup basis. Both are usually considered to be constant, but either may also be variable. In addition, several authors have considered a third possibility recently summarized by Mueller [3]. They suggest a firm-controlled, or seller-managed margin. In this case, market power may allow sellers the freedom to adjust prices and margins at their discretion. This seems applicable to the fluid milk industry since there appears to be some reluctance by processors and retailers, given consumer reaction, to allow prices to fluctuate too widely or too frequently.

OBJECTIVE, DATA AND PROCEDURE

The objective of this paper is to examine the movement of marketing margins of fluid milk during a period of constantly increasing farm prices. Margin movement will be assessed in each of three selected geographic markets for lowfat milk (with increasing per capita consumption) and for whole milk (with declining per capita consumption). In addition to total marketing margins, retail and processor margins are also analyzed.

The analysis is based on observed marketing margins[1] in three fluid milk markets in Kentucky—Lexington, Louisville and Paducah. Data used covered

TABLE 2. SALES OF WHOLE MILK ITEMS, LOWFAT AND SKIM MILK ITEMS, AND LOWFAT MILK AS A PERCENTAGE OF TOTAL SALES IN THE LOUISVILLE-LEXINGTON-EVANSVILLE AND PADUCAH FEDERAL MILK ORDER MARKETS, JULY 1962

	July 1962				July 1968				July 1974			
	As percentage of total sales			Lowfat milk[a] as % of	As percentage of total sales			Lowfat milk[a] as % of	As percentage of total sales			Lowfat milk[a] as % of
Marketing Area	Whole milk items[b]	Lowfat and skim milk items[c]	Total Sales	Lowfat and skim milk items	Whole milk items[b]	Lowfat and skim milk items[c]	Total Sales	Lowfat and skim milk items	Whole milk items[b]	Lowfat and skim milk items[c]	Total Sales	Lowfat and skim milk items
	Percent				Percent				Percent			
Louisville-Lexington-Evansville	87.9	12.1	5.2	43.1	81.6	18.4	11.3	61.2	61.2	38.8	30.3	78.1
Paducah	87.3	12.7	2.4	19.0	85.6	14.4	6.5	44.9	78.1	21.9	13.7	62.5
All Federal Milk Order Markets	90.3	9.7	2.3	24.0	83.8	16.2	9.0	55.4	71.8	28.2	19.5	69.1

SOURCE: USDA, AMS, *Federal Milk Order Market Statistics,* FMOS-177, November 1974.

[a]Data represent the market areas after all mergers, name changes, and expansions up to July 1974. To the extent possible, data for previous years have been adjusted to accommodate these marketing area changes in order to make the data for previous years comparable to the present year.

[b]Plain and flavored whole milk.

[c]Plain, fortified and flavored skim; plain and fortified one percent and two percent lowfat milk; and buttermilk.

[1]Three marketing margins are included—total, processor and retail. Total marketing margin is the difference between the retail price of milk (on a 1/2 gallon basis) and its farm value; processor margin is the difference between the wholesale price and farm value, and retail margin represents the difference between the retail price and wholesale price. Thus, the margins include the costs incurred and profits enjoyed by all the respective agencies involved in transferring milk from farmers to consumers.

a 102-month period (January 1965 through June 1973), during which the farm price of milk trended upward. Margins were observed for whole milk (3.25 percent butterfat), and for lowfat milk (2.0 percent butterfat).

Monthly retail price data as well as dealers' pay price for raw milk were available from the Fluid Milk and Cream Report [8]. Wholesale prices were obtained from the Kentucky Milk Marketing and Anti-monopoly Commission.[2] All prices, converted to 1/2 gallon unit bases, were expressed in 1967 dollars and adjusted to account for butterfat differences.[3] Price data for whole milk were available for the entire 102-month period; for lowfat milk since January 1969. To the extent that costs other than farm milk price influence fluid milk margins, adjusting milk prices to a 1967 base should hold constant their effect on prices and margins.

The availability of wholesale prices provided a means for breaking the total marketing margin for each product (whole and lowfat milk) into processor margins and retailer margins, making an analysis of three margins possible.

The following regression equations were used to test the hypothesis that marketing margins are absolute and constant, therefore unrelated to changes in the farm price of milk:

$$M_m = a \pm bP_f$$

$$M_r = a \pm bP_f$$

$$M_P = a \pm bP_f$$

where

M_m = market margin
M_r = retail margin
M_P = processor margin
P_f = farm price.

On an assumption that the wholesale price of milk (P_w) might have a greater effect on retail margins than does farm price, the following equation was also estimated:

$$M_r = a \pm bP_w$$

where P_w = wholesale price.

While other variables might be identified which could, in theory, be postulated to influence observed margins, analysis was limited to the relationship between prices (farm and wholesale) and margins.

If the null hypothesis is rejected, then coefficients of P_f or P_w will significantly differ from zero. An alternate hypothesis, where the beta coefficients are positive and significantly different from zero, would be suggestive of pricing on the basis of a percentage margin. On the other hand, significant but negative beta coefficients could lend support to the hypothesis of a seller-controlled margin, where sellers cushion the effect of price changes through the marketing margin, thus avoiding frequent price adjustments. This type of flexibility, however, implies a certain degree of market power on the part of the seller.

RESULTS

Regression results are shown in Tables 3 and 4. In nine out of 12 whole milk equations and 10 out of 12 lowfat milk equations, a significant relationship was found between changes in farm and wholesale price of milk and the various margins. Also, in 17 of the 19 equations where a significant relationship was found, the sign of the coefficient was negative.[4]

Few differences were evident between whole and lowfat milk results except that coefficients tend to be larger, confidence levels somewhat higher, and R^2 values larger in lowfat milk than in whole milk equations.

There was some tendency for lower confidence levels and smaller coefficients and R^2 values in processor margins than in market or retail margins. Further, beta coefficients were not significant in three of the six equations. The implication, therefore, is that processor margins tend to be less responsive than others to changes in farm prices.

A stronger relationship was found between wholesale prices and retail margins than between farm prices and retail margins.

Five equations (3.4, 3.8, 3.10, 4.4, and 4.10) had insignificant beta coefficients. An additional test was run to determine if those insignificant coefficients were due to constant margins, thus not responsive to

[2] Kentucky's Milk Marketing Law, KRS 260.675 to 260.760, requires that handlers file price changes with the Commission 20 days prior to the effective date. Wholesale prices then become public information.

[3] Prices were deflated to a 1967 base using the following: Dealers' buying price, Farm Price Index; wholesale price, Wholesale Index; and retail prices, Consumer Price Index. Federal order butterfat differentials were then used to adjust for differences in butterfat.

[4] An analysis of residuals suggested a degree of autocorrelation was present, not an uncommon occurrence in time-series data. Distributed-lag equations were used of one, two and three months. These did not improve the regression results. The presence of autocorrelation, however, should not hamper the present analysis as one can continue to expect unbiased estimates but with large coefficient standard errors relative to those one would get from more efficient estimation procedures, Johnston [2].

TABLE 3. REGRESSION RESULTS FOR WHOLE MILK, PADUCAH, LOUISVILLE, AND LEXINGTON MARKETS, 1965-1973

(Values in parentheses are t-ratios)

Paducah:		
3.1	$M_m = 34.267 - 0.336\ P_f$ (20.9)	$R^2 = 0.189$
3.2	$M_r = 12.205 - 0.248\ P_f$ (3.77)	$R^2 = 0.125$
3.3	$M_r = 20.754 - 0.331\ P_w$ (6.26)	$R^2 = 0.281$
3.4	$M_p = 22.061 - 0.088\ P_f$ (1.33)	$R^2 = 0.017$
Louisville:		
3.5	$M_m = 46.022 - 0.829\ P_f$ (8.02)	$R^2 = 0.391$
3.6	$M_r = 27.097 - 0.936\ P_f$ (9.57)	$R^2 = 0.478$
3.7	$M_r = 36.400 - 0.694\ P_w$ (9.97)	$R^2 = 0.499$
3.8	$M_p = 18.925 + 0.107\ P_f$ (1.31)	$R^2 = 0.016$
Lexington:		
3.9	$M_m = 33.432 - 0.253\ P_f$ (2.76)	$R^2 = 0.071$
3.10	$M_r = 5.368 + 0.085\ P_f$ (0.50)	$R^2 = 0.002$
3.11	$M_r = 44.345 - 0.859\ P_w$ (10.24)	$R^2 = 0.512$
3.12	$M_p = 28.064 - 0.338\ P_f$ (2.76)	$R^2 = 0.071$

TABLE 4. REGRESSION RESULTS FOR LOWFAT MILK, PADUCAH, LOUISVILLE, AND LEXINGTON MARKETS, 1969-1973

(Values in parentheses are t-ratios)

Paducah:		
4.1	$M_m = 40.021 - 0.546\ P_f$ (8.84)	$R^2 = 0.600$
4.2	$M_r = 14.666 - 0.378\ P_f$ (5.67)	$R^2 = 0.382$
4.3	$M_r = 27.497 - 0.488\ P_w$ (11.92)	$R^2 = 0.732$
4.4	$M_p = 25.355 - 0.186\ P_f$ (1.92)	$R^2 = 0.066$
Louisville:		
4.5	$M_m = 61.899 - 1.584\ P_f$ (9.13)	$R^2 = 0.616$
4.6	$M_r = 46.081 - 1.757\ P_f$ (8.57)	$R^2 = 0.586$
4.7	$M_r = 70.820 - 1.522\ P_w$ (11.67)	$R^2 = 0.724$
4.8	$M_p = 15.808 + 0.174\ P_f$ (2.42)	$R^2 = 0.101$
Lexington:		
4.9	$M_m = 44.235 - 0.920\ P_f$ (5.82)	$R^2 = 0.395$
4.10	$M_r = 11.892 - 0.386\ P_f$ (1.37)	$R^2 = 0.349$
4.11	$M_r = 73.701 - 1.646\ P_w$ (15.44)	$R^2 = 0.821$
4.12	$M_p = 32.343 - 0.534\ P_f$ (3.71)	$R^2 = 0.209$

changes in farm prices, or were variable but not correlated with the farm price. The null hypothesis was tested to determine if the variances of these margins were equal to zero, under assumption that the sample variance was a first approximation of the population variance. In all five cases, the null hypothesis of zero variance was rejected.[5] Thus, margins in these five cases were neither absolute and constant nor correlated with farm price.

OBSERVATIONS

The results allow a few observations. First, the somewhat popular notion that margins are absolute or established on a percentage basis does not seem well-founded in these markets. Second, no difference was obvious between lowfat and whole milk markets, although consumption patterns differ and are changing.

Third, regression results, where coefficients are significant but negative, may provide some support for the hypothesis of seller-controlled margins. Firms (processors or retailers) may tend to hold their selling prices constant relative to the prices they pay for fluid milk and allow their margins to vary. This should not be too surprising in the food industry, particularly for milk. Marketing firms, especially retailers, seem interested in avoiding frequent price adjustments, and hence tend to cushion the effect of price changes by narrowing margins when farm prices rise and widening them as farm prices fall. To have this flexibility, however, implies a certain degree of market power within the firm.

Finally, these results may provide some basis for hypothesizing regarding shifts in market power within the system. Testing this hypothesis would require a more thorough analysis of changes in processor and retailer margins than was possible given the scope of this study and the data available.

[5] Values obtained were 2.10 and 4.87 in the lowfat equations where $X^2/df = 1.75$ at the 0.05 level and values of 2.95, 2.92 and 11.86 in the whole milk equations where $X^2/df = 1.53$ at the .05 level.

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