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California Milk Marketing Margins

Hoy F. Carman

This article uses monthly price data to estimate farm-retail price response equations for three California market areas. The results indicate that there is a strong direct relationship between retail and farm-level milk prices—retailers increase and decrease their prices equally in response to f.o.b. price increases and decreases. While the total retail response to farm price increases and decreases is equal, the timing of the adjustments is not. Farm price increases during a given month led to retail price increases during the same month while farm price decreases were not fully reflected in retail prices until the following month.

Introduction

The relationship between California farm-level and retail milk prices has recently been the focus of Consumers Union press releases and news stories based on surveys of retail milk prices in Los Angeles and San Francisco area food stores (Odabashian, 1997a, 1997b). Retail prices from these surveys were used to charge that large supermarket chains were "gouging" consumers and that gouging was the primary cause of surging retail milk prices, which were leading to an increasing gap between the price per gallon received by farmers and the price paid by consumers.[1] It was observed that:

> *When the farm price increases even a penny, grocers generally raise the price to consumers quickly and exponentially. When the farm price drops, as it has three times in the past two years, grocers have slowly passed on a fraction of the decrease to their customers. If that historical trend continues, the large gap between the farm price and the price consumers pay will steadily grow.*

The Consumers Union used their September 1996 Bay Area milk price survey to call on the California Attorney General to "investigate whether there exists an unspoken agreement on the part of the major Bay Area supermarket chains to set the price of milk." There was an investigation, and on July 22, 1997, the Attorney General's office announced that they had "found there is no evidence of an agreement to establish prices among the supermarkets." Questions remain, however, concerning the relationships between farm and retail milk prices and food retailers' pricing methods and practices.

The purpose of this article is to examine the relationship between farm-level and retail prices for whole fluid milk in California over time. The focus is on the responsiveness of retail milk prices to both increases and decreases in farm-level prices, with attention to the possible lags involved. The relationship between increasing margins over time and changes in marketing costs, which are the major determinants of the difference between farm-level and retail prices for food, is also examined.

Approach

Consumers' concerns about changing food prices, especially for frequently purchased staple items, such as milk, are a persistent issue. The response of retail-level prices to price changes at the farm and wholesale level in the marketing system has been examined by several researchers for a mix of food products. The general approach used in this study is similar to that previously employed by Kinnucan and Forker (1987) for dairy products; Heien (1980) for a market basket of 22 fresh and processed foods; Ward (1982) for fresh vegetables; and Pick et al. (1990) for fresh lemons and oranges.

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[1] For the most recent of several similar reports, see Odabashian (1997a, 1997b). The Consumers Union's Milk Price Survey was collected anonymously by walking into retail stores and making notations of the advertised prices of milk. The latest survey in Los Angeles collected prices from 77 stores. A February 6, 1997, survey collected milk prices from 108 stores in the San Francisco Bay Area.

Monthly farm-level and retail prices for whole milk are used to examine the price transmission process for three retail market areas: Los Angles, San Francisco, and Sacramento. Wholesale level pricing is not examined since many food retailers are integrated into milk processing and there is no wholesale price series readily available. Thus, the farm to retail marketing margin examined includes the costs of processing, packaging, transportation, and all wholesaling and retailing activities.

The response of retail-level milk prices to increases and decreases in the farm price for milk is examined using Houck's (1977) model for estimating nonreversible functions. With this model, changes in the retail price (PR) are linked to increases (PFU) and decreases (PFD) in the farm-level price (PF). The model is specified as:

$$\textbf{(1)}\quad PR_t = a_0 t + a_1 PFU_t + a_2 PFD_t + a_3 C_t + e_t ,$$

where

$$PR_t = P_t - P_0 ;$$

$$PFU_t = \sum_{i=1}^{n} (PF_t - PF_{t-1}), \text{ if } PF_t > PF_{t-1},$$
and zero otherwise;

$$PFD_t = \sum_{i=1}^{n} (PF_t - PF_{t-1}), \text{ if } PF_t < PF_{t-1},$$
and zero otherwise; and

C_t = an index of marketing costs.

Thus, PR_t is the change in retail price at period t (P_t) from its initial value at period 0 (P_0). PFU is the sum of all month-to-month increases in the farm-level price from its initial value up to month t, and PFD is the sum of all month-to-month decreases in the farm-level price from its initial value to month t. As noted by Houck (1977), if the constant a_0 is not zero, it appears in equation (1) as a trend coefficient. The index of marketing costs (C_t) is the U.S. Department of Agriculture's total marketing cost index (USDA/ERS, monthly issues). This index measures changes in the major marketing cost components, such as labor, transportation, and packaging materials, from its initial value in period 0. A hypothetical example of the computation of the farm price variables PFU and PFD is given in Table 1.

If farm-level and retail prices move together, then both a_1 and a_2 will be positive. If the retail price response to changes in the farm price for milk are equal (symmetric) for both price increases and decreases, then one would expect to find that $a_1=a_2$. The t-statistic is used to test the null hypothesis that retail price movements are symmetric versus the alternative hypothesis that they are asymmetric (that $a_1>a_2$ or $a_1<a_2$). The magnitude of the a_1 and a_2 coefficients can provide information on retail and wholesale (processor) pricing methods. For example, if retailers and wholesalers use a fixed percentage markup, the two coefficients will be greater than one; if they use a constant dollar markup, the two coefficients will be equal to one; and a combination percentage and dollar markup will yield coefficients greater than one. If retailers and wholesalers follow a practice of trying to maintain stable prices, then the two coefficients will be positive but less than one.

Table 1. Example of Derivation of Segmented Variable from 10 Hypothetical Farm Price Observations.

Month	Farm Price, $/gal.	PFU[a]	PFD[b]
1	1.30	0	0
2	1.30	0	0
3	1.31	.01	0
4	1.29	.01	.02
5	1.29	.01	.02
6	1.35	.07	.02
7	1.37	.09	.02
8	1.41	.13	.02
9	1.35	.13	.08
10	1.30	.13	.13

[a]PFU is the cumulative sum of price increases.
[b]PFD is the cumulative sum of price decreases.

Data

The analysis covers the 147-month period from January 1985 through March 1997. The monthly minimum producer prices for class 1 milk (f.o.b. processing plant) reported in the *California Dairy Information Bulletin* for two production areas, Northern California and Southern California, are used for the analysis (California Department of Food and Agriculture, monthly issues). Minimum producer prices are calculated by pricing formulas established under California state legislation. Note that the state is not involved in setting milk prices at the wholesale or retail levels. The retail price data for three market areas—Los Angeles, San Francisco, and Sacramento—are also taken from the *California Dairy Information Bulletin.*

The behavior of retail milk prices for the Los Angeles market over the period of analysis is illustrated by the data in Figure 1. Price and margin trends for San Francisco and Sacramento were generally similar to those observed for Los Angeles. As shown, average retail prices varied around $2.00 per gallon from January 1985 through January 1989; average retail prices then began a rather steady upward climb, reaching $2.73 per gallon from October 1992 through March 1993; there was a sharp drop in average retail prices in April 1993 when data collection procedures were changed;[2] average retail prices remained under $2.61 per gallon until July 1995, and then they began a steady increase, reaching $2.99 per gallon in December 1996 and January 1997; average retail prices then decreased to $2.70 per gallon in March 1997. When adjusted for changes in the general level of prices as measured by the Consumer Price Index (March 1997 = 100), the average real retail price of milk per gallon in Los Angeles shows periods of increasing and decreasing price trends, but the real price in March 1997 ($2.70) was well below the real price in January 1985 ($3.05). Data on the actual milk marketing margin (retail price minus producer price) for the Los Angeles market reveals significant variability but with an upward trend over the 12-year period (Figure 2). In real terms, the margin was higher in March 1997 ($1.45) than in January 1985 ($1.23), but it decreased slightly from April 1993 ($1.53) to March 1997 ($1.45) when A.C. Nielsen collected the retail price data.

Estimation and Results

The price response model specified in equation (1) was estimated for two periods for each of the three retail markets. The two periods, which yielded similar results, included the total of 147 months (January 1985 through March 1997) and the last 48 months (April 1993 through March 1997), corresponding to the period when retail prices were collected by A.C. Nielsen. Significant serial correlation was evident in all of the equations estimated; a Cochrane-Orcutt iterative-type procedure in *SHAZAM* (1993) was used to reestimate each of the equations.

Previous studies have found evidence of lagged price adjustments extending up to three months for fluid milk (Kinnucan and Forker, 1987). The procedure used in this study was to estimate equation (1) for each market using an Almon distributed lag model with an initial lag of three months specified. The number of months lagged was then reduced to include only the lagged coefficients that were significantly different than zero. The results of this procedure were consistent for all six equations. There were no statistically significant lags evident for farm-level milk price increases; retail prices increased fully during the same month. When farm-level milk prices decreased, however, there was a one-month lag in each market before retail prices fully adjusted. There was no statistical evidence that retail prices required more than one month to adjust to farm price decreases. Given the consistent results for retail price adjustments to farm price changes, the estimated coefficients for price increases (Σa_1) are for one month (the current month), and the estimated coefficients for price decreases (Σa_2) are for two months (the current and the previous month). The estimated equations are shown in Table 2.

[2] Retail milk prices for the period from January 1985 through March 1993 were collected by the California Department of Food and Agriculture during the first week of each month from five stores in Sacramento, four stores in San Francisco, and seven stores in Los Angeles. Since April 1993, the Department has contracted with A.C. Nielsen to provide the retail price survey data. The Nielsen prices, from Scantrack Reports on Refrigerated Milk, are a weighted average of prices for a four-week period.

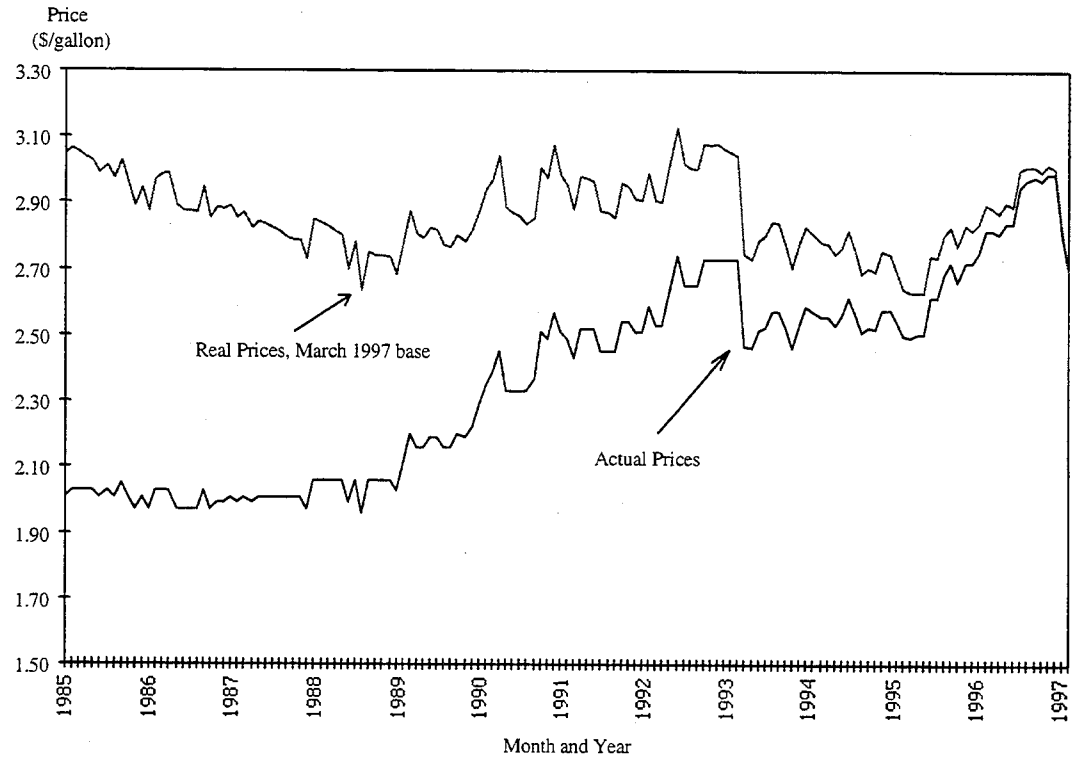

Figure 1. Los Angeles Retail Milk Prices, Monthly Actual and Real, January 1985 through March 1997.

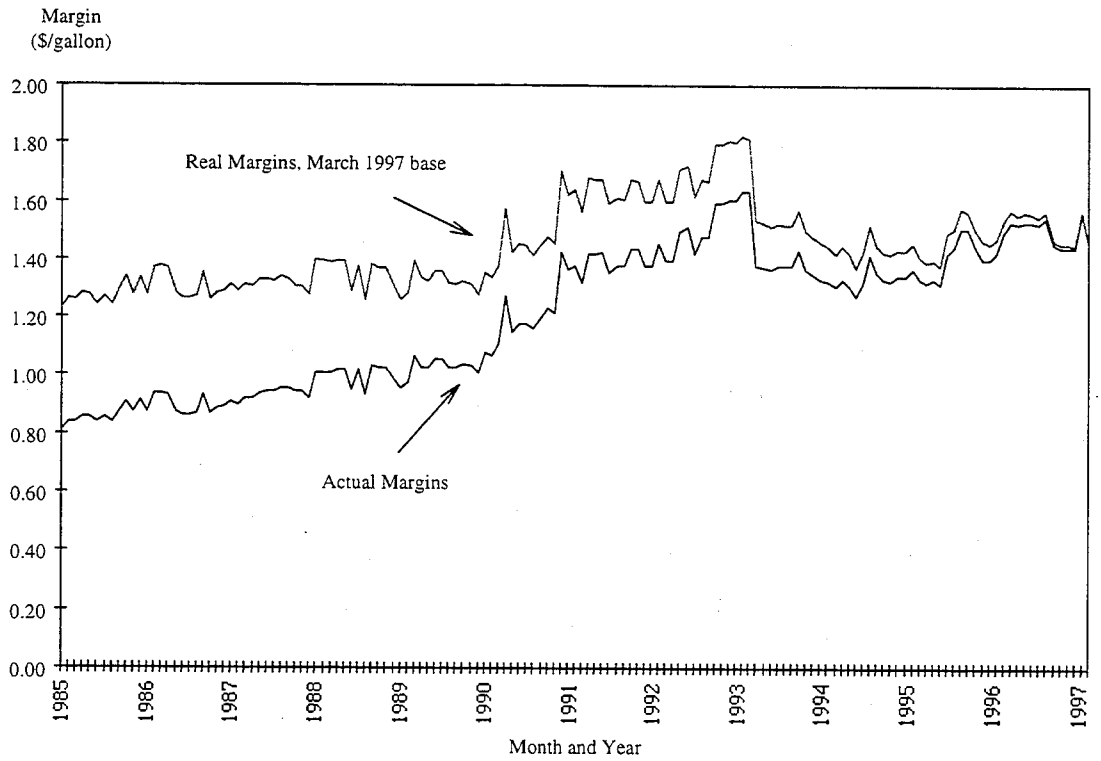

Figure 2. Los Angeles Milk Marketing Margins, Monthly Actual and Real, January 1985 through March 1997.

Table 2. Price Parameter Estimates for Retail Milk Price Response to F.O.B. Price Changes by Major Retail Market.

Market	Period	Price Parameter Estimates				Statistics	
		a_0	Σa_1	Σa_2	a_3	R^2	D.W.
Sacramento	Jan. 1985 through Mar. 1997	0.039 (0.023)[a]	1.105 (0.095)	1.098 (0.120)	0.020 (0.006)	.98	1.98
San Francisco		0.040 (0.027)	1.168 (0.129)	0.942 (0.169)	0.015 (0.008)	.97	2.01
Los Angeles		0.139 (0.076)	0.875 (0.135)	0.620 (0.163)	0.011 (0.010)	.98	1.93
Sacramento	Apr. 1993 through Mar. 1997	0.373 (0.195)	1.122 (0.117)	1.173 (0.170)	0.006 (0.014)	.97	1.96
San Francisco		0.398 (0.218)	1.184 (0.138)	1.034 (0.200)	0.001 (0.016)	.97	1.95
Los Angeles		0.619 (0.228)	0.757 (0.110)	0.939 (0.166)	0.008 (0.012)	.97	1.80

[a]The numbers in parentheses are standard errors for the estimated coefficients.

The estimated results for the total period and the most recent 48 months (April 1993 through March 1997) are very similar. The variables included in the equations explain from 96–98 percent of the variation in retail milk prices, as shown by the R^2 statistics. Each of the estimated coefficients for price increases (Σa_1) and for price decreases (Σa_2) was significantly greater than zero, indicating that f.o.b. and retail milk prices move up and down together.

Statistical results of the analysis are summarized by the hypothesis tests in Table 3.[3] While there was a positive trend in retail prices for each market and time period, it was statistically significant ($a_0>0$) only for Los Angeles for the most recent 48-month period. The response of retail milk prices to marketing cost changes, as measured by the cost index used, was not as important as expected. Each of the estimated coefficients for the marketing cost variable (a_3) is positive, but only one (Sacramento, 1985 to 1997) is statistically significant. The index may not adequately measure marketing cost changes for fluid milk in California due to the nature of the costs included and the weights utilized in the index.

The estimated coefficients for farm price increases are larger than for farm price decreases in three equations; the coefficients are equal in one equation; and the price increase coefficients are smaller than the price decrease coefficients in two equations (Table 2). The hypothesis test for symmetry, however, indicates that none of the differences is statistically significant at the 95 percent confidence level. As shown in Table 3, the null hypothesis that $\Sigma a_1-\Sigma a_2=0$ is accepted for each equation, leading to the conclusion that the response of retail milk prices to f.o.b. price changes is not significantly different for increases or decreases of f.o.b. prices.

As noted earlier, the size of the estimated f.o.b. price coefficients Σa_1 and Σa_2 can provide information on retail pricing practices. The hypothesis that $\Sigma a_1=1$ was accepted for five of the six equations as was the hypothesis that $\Sigma a_2=1$ (Table 3). The one-for-one price transmission process is consistent with constant dollar markup pricing. The hypothesis that $\Sigma a_1=1$ was rejected for the Los Angeles market for the most recent four-year period, and the alternative that $\Sigma a_1<1$ was accepted. This indicates that Los Angeles retailers were maintaining stable retail prices by absorbing some of the cost increases. The hypothesis that $\Sigma a_2=1$ was rejected for the Los Angeles market for the entire period (January 1985 through March 1997), and the alternative that $\Sigma a_2<1$ was accepted. This also indicates that Los Angeles retailers were maintaining stable retail prices by reducing retail prices less than farm prices decreased.

Conclusions

Data used for this analysis indicate that the retail price of milk in current dollars has been trending up over time, but they also show that

[3] The t-statistics for each of the hypothesis tests were calculated using the TEST command in *SHAZAM*.

Table 3. Hypothesis Tests for Estimated Retail Milk Price Coefficients by Major Retail Market.

Market	Period	Null Hypothesis				
		$\Sigma a_1 - \Sigma a_2 = 0$	$\Sigma a_1 = 1$	$\Sigma a_2 = 1$	$a_0 = 0$	$a_3 = 0$
Sacramento	Jan. 1985 through Mar. 1997	t =0.064 accept [a]	t =1.105 accept	t =0.812 accept	t =1.654 accept	t =3.287 reject
San Francisco		t =1.483 accept	t =1.299 accept	t =-0.344 accept	t =1.469 accept	t =1.959 accept
Los Angeles		t =1.377 accept	t =-0.921 accept	t =-2.335 reject	t =1.840 accept	t =1.167 accept
Sacramento	Apr. 1993 through Mar. 1997	t =-0.270 accept	t =1.038 accept	t =1.017 accept	t =1.917 accept	t =0.461 accept
San Francisco		t =0.673 accept	t =1.335 accept	t =0.169 accept	t =1.826 accept	t =0.049 accept
Los Angeles		t =-0.983 accept	t =-2.212 reject	t =-0.366 accept	t =2.710 reject	t =0.698 accept

[a]All hypothesis tests are made at the 95% confidence level.

there has been no clear trend in real milk prices (prices adjusted for the inflation). In real terms, the recent Los Angeles average retail milk price of $2.70 per gallon in March 1997 was lower than at any other time in the past 12 years except for the periods from February through June 1995, September through November 1994, November 1993, January 1989, and June and August 1988. Real marketing margins demonstrated an upward trend over the total period, but there has been no clear trend since 1993.

This analysis provides answers to several questions concerning the relationship between f.o.b. and retail milk price changes. First, there is a strong direct relationship between retail and farm-level milk prices. As noted, retailers increase their prices in response to f.o.b. price increases, and they also reduce prices in response to f.o.b. price decreases. Second, there is no statistical evidence that California food retailers increase milk prices more when f.o.b. prices increase than they decrease retail prices when f.o.b. prices decrease. Third, there is statistical evidence that Los Angeles retailers have maintained stable retail prices through absorbing cost increases and not fully passing on cost decreases. There is a difference in the time required for retail milk prices to respond to f.o.b. price increases and decreases. For each market, f.o.b. price increases during a given month led to retail price increases in the same month; there was no lag in retail price response to f.o.b. price increases. There was, however, a significant one-month lag between farm price decreases and total retail price decreases for each market area. The retail price adjustment process to decreased producer prices, which begins during the month of the price change, requires the following month to be completed.

References

California Department of Food and Agriculture. Monthly issues. *California Dairy Information Bulletin.* Dairy Marketing Branch, California Agricultural Statistics Service, Sacramento, California.

Heien, D.M. 1980. "Markup Pricing in a Dynamic Model of the Food Industry." *American Journal of Agricultural Economics* 62(1):11–18.

Houck, J.P. 1977. "An Approach to Specifying and Estimating Nonreversible Functions." *American Journal of Agricultural Economics* 59(3): 570–72.

Kinnucan, H.W., and O.D. Forker. 1987. "Asymmetry in Farm-Retail Price Transmission for Major Dairy Products." *American Journal of Agricultural Economics* 69(2):285–92.

Odabashian, E. "Got Moo-La? Bay Area Grocers Continue to Gouge Consumers on Milk." March 1997. Consumers Union of U.S., Inc., West Coast Regional Office.

Odabashian, E. "Got Moo-La? Los Angeles Grocers Continue to Gouge Consumers on Milk." June 1997. Consumers Union of U.S., Inc., West Coast Regional Office.

Pick, D.H., J. Karrenbrock, and H.F. Carman. 1990. "Price Asymmetry and Marketing Margin Behavior: An Example for California-Arizona Citrus." *Agribusiness* 6(1): 75–84.

SHAZAM User's Reference Manual Version 7.0. 1993. McGraw-Hill.

USDA/ERS (U.S. Department of Agriculture, Economic Research Service). Monthly issues. *Agricultural Outlook.* Washington, D.C.

Ward, R.W. 1982. "Asymmetry in Retail, Wholesale, and Shipping Point Pricing for Fresh Vegetables." *American Journal of Agricultural Economics* 64(2):205–12.