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Determinants of the Farm-to-Retail Milk Price Spread

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In this report... *Farm-to-retail milk price spreads increased significantly during late 1990 and early 1991 as farm prices decreased while retail prices either stayed the same or else went down more slowly. In this report, farm-level fluid milk prices and processor costs are estimated from USDA's Agricultural Marketing Service data and from firm-level data acquired from a private cost-accounting company for the period 1974-91. These data indicate that the greatest portion of the farm-to-retail price spread increase occurred at the retailer level. Processor profits also increased but not enough to account for the increased price spread. Comparisons of the fluid milk price spread with other food price spreads indicate that the milk price spread had lagged behind other food price spreads since 1986 but then caught up in 1990 and 1991. A study of price transmission between 1983 and 1990 indicates that retail prices react more quickly and completely to farm price increases than to farm price decreases.*

During late 1990 and early 1991, record-high retail milk prices and rapidly declining farm milk prices caught the attention of dairy industry leaders, the administration, and Congress. During this period, milk price spreads, the difference between the farm milk price and the retail price, grew rapidly and reached their highest level, $18.51 per hundredweight (cwt), in 1991. Retail whole milk prices had increased by $7.43 per cwt since 1980, while producer milk prices decreased 46 cents. Whether retailers or processors or both were responsible for the increasing price spread was unknown. This report examines components of the price spread and other measures of industry performance to discover the causes of the widening price spreads.

Price spreads provide a measure of market performance and gauge the performance of processor-distributors and retailers in the industry. Data from fluid milk processor-distributors are used to calculate operating costs, gross and net profit margins, and estimates of processing and wholesaling costs. Then, along with retail prices from the Bureau of Labor Statistics (BLS) and producer prices from U.S. Department of Agriculture's (USDA) Agricultural Marketing Service (AMS), the traditional farm value and marketing costs are used to estimate an apparent farm-to-retail price spread and retailing margin.

Direct measures of the processor and retailer spreads (retailing margin) are difficult to estimate accurately because the processor-distributor data include the costs and prices for cottage cheese and ice cream as well as fluid milk. Thus, the estimate of the retailing margins only approximates the actual spread between processors and retailers. To compensate for the data problems, we compared the aggregate food processing, wholesaling, retailing, and price spread indexes to determine if the fluid milk margins were in line with the average for all food industries. Additionally, the nominal price spread was compared with the real price spread to determine if changes during 1990 and 1991 were different from past changes. Lastly, the effective Class I milk price and the wholesale and retail milk price data from BLS were analyzed to determine the most accurate prediction of the farm-to-retail price spread and evidence of asymmetric pricing.[1]

[1]The effective Class I price is the weighted average announced Class I minimum price in the Federal order system plus the weighted average of any overorder charges. Overorder charges are bargained for by cooperatives to cover costs not included in the minimum price.

Margins of Fluid Milk Processor-Distributors

Data from a representative sample of 30 milk processor-distributor plants east of the Rocky Mountains were used to calculate processing and wholesaling costs for fluid milk. The sample plants provided cost and sales data on a quarterly basis to a consulting firm of which they were clients, using a unified accounting system. The sample contained no producer-handlers or retail grocery food chains. At times, sample plants were replaced by similar plants when data were insufficient. Most of the plants had been clients of this consulting firm for many years (Jones).[2]

These data were divided into general categories of net sales receipts, raw material and other product costs, and operating costs. The categories were used to obtain the gross and net margin. The gross margin is the difference between net sales receipts and raw material and other product costs. Net margin is the gross margin less operating costs.

Net sales receipts represent the revenue that processor-distributors received for their fluid milk products, cottage cheese, ice cream, and other products (table 1). The processor-distributors did not report the proportion of total net sales receipts of each product. Net sales receipts per cwt of raw milk processed (RMP) remained relatively stable from 1983 to 1985 but started downward during the 1986-88 period. Net sales increased $2.31 per cwt of RMP from 1988 to 1990 but declined 94 cents in 1991. Net sales receipts per cwt of RMP tend to follow the change in the value of milk and cream costs. The Dairy and Tobacco Adjustment Act of 1983 and the Food Security Act of 1985 reduced the price support level and were primary reasons for the decrease in the net sales receipts. The Common Agriculture Policy (CAP) reform of the European Community led to increasing farm milk prices in 1989, which were reflected in increased net sales receipts. Until mid-1990, processors' anticipation of continued CAP reform led to higher demand for manufactured products and, hence, higher beverage milk prices. In late 1990, milk supplies began to outstrip demand, and sales receipts fell in 1991.

Raw materials and other product costs consist of payments for raw milk, finished products for resale, and other products (ingredients other than milk, cream, and skim milk). Farm milk and cream costs were the highest in 1990 at $13.66 per cwt after slumping to $11.81 in 1988. Raw milk and cream costs continued to decline as a share of processor-distributor raw product input costs, making up 77 percent of costs in 1991 compared with 80 percent in 1983. Finished products for resale include products and materials purchased from other firms to complete the processor-distributors' product line. Costs of finished products for resale grew 18 percent (36 cents per cwt) from 1983 to 1991. Other ingredient costs remained fairly stable, rising only 3 cents per cwt during the same period. Total raw material costs followed declining milk and cream prices in 1983-88 but increased rapidly in 1989 and 1990 and then declined in 1991. Raw material costs made up 67 cents of each sales dollar in 1983 and fell to 63 cents in 1991. Raw material costs fell 78 cents per cwt between 1983 and 1991. Gross margins represent the money remaining to pay for operating and processing costs after paying the raw material and other product costs. Gross margins rose $1.02 from 1983 to 1990. Except for a drop in 1987 to accommodate increases in operating costs, gross margins increased every year. The drop in 1987 can be attributed to higher finished costs and raw materials and other products even as net sales receipts decreased 15 cents per cwt RMP.

Operating costs grew 7 percent from 1983 to 1991 but peaked in 1989 at $8.70 per cwt RMP. Operating costs include processing, distribution, procurement, and general costs. Labor costs have remained fairly constant, dropping only 2 percent since 1983. Rent, depreciation, and repairs have increased by 14 percent from 1983 to 1991, an annual rate of 1.7 percent. The ratio of labor costs to rent, depreciation, and repairs has fallen from 3.7 to 3.2. Processing in the fluid milk industry seems to have become more capital intensive. Insurance doubled to 16 cents per cwt between 1983 and 1986 but has remained fairly constant at 16-17 cents since. Advertising expenses have been relatively constant, while general expenses have risen nearly twofold.

Net margins represent the profit and return on equity from each cwt RMP for the 30 processor-distributors. Net margins grew from 41 cents per cwt in 1983 to 104 cents in 1991, up 154 percent. In 1985, the net margin was high because net sales receipts increased 10 cents as the raw material and other product costs decreased by 38 cents. Net margins were at their peak in 1991 at $1.04, due primarily to higher gross margins. It appears that net sales have increased more than enough to keep pace with

[2]The names in parentheses refer to items cited in the References at the end of this report.

Table 1--Net sales, costs, and margins for 30 fluid milk processor-distributors

Account	1983	1984	1985	1986	1987	1988	1989	1990	1991
	Dollars per hundredweight of volume processed								
Net sales receipts[1]	25.53	25.19	25.29	24.91	24.76	24.56	25.85	26.87	25.93
Raw materials and other product costs:									
Milk and cream	13.66	13.38	12.90	12.38	12.25	11.81	12.78	13.56	12.49
Finished products	2.03	1.96	1.95	2.03	2.17	2.20	2.29	2.38	2.39
Other[2]	1.40	1.43	1.52	1.37	1.39	1.44	1.58	1.47	1.43
Total	17.09	16.76	16.37	15.78	15.81	15.45	16.64	17.41	16.31
Gross margin	8.44	8.43	8.92	9.13	8.95	9.11	9.21	9.46	9.62
Operating costs:									
Salaries, wages, and commissions[3]	3.65	3.52	3.50	3.67	3.60	3.63	3.61	3.57	3.59
Containers	1.71	1.74	1.80	1.81	1.82	1.95	2.08	1.93	1.92
Operating supplies	0.60	0.59	0.56	0.50	0.48	0.50	0.52	0.56	0.55
Rent, depreciation and repairs	0.99	0.96	1.03	1.12	1.11	1.13	1.11	1.12	1.13
Taxes	0.12	0.12	0.13	0.13	0.12	0.14	0.15	0.13	0.14
Insurance	0.08	0.08	0.10	0.16	0.17	0.17	0.17	0.16	0.16
Services	0.58	0.62	0.56	0.62	0.61	0.61	0.66	0.62	0.62
Advertising	0.14	0.13	0.14	0.15	0.15	0.14	0.14	0.15	0.18
General	0.15	0.18	0.23	0.22	0.23	0.21	0.26	0.28	0.29
Total	8.02	7.94	8.05	8.38	8.29	8.48	8.70	8.52	8.58
Net Margin[4]	0.42	0.49	0.87	0.75	0.66	0.63	0.51	0.94	1.04

[1] Gross sales receipts less discounts, allowances, and damaged product returns.
[2] Ingredients other than milk, cream, and skim milk used to make cottage cheese, ice cream, orangeade, and other products.
[3] Includes cost of fringe benefits, such as State and Federal unemployment, Federal old age benefits, workers' compensation, and pensions.
[4] Net returns to owners before income tax.

increases in raw material costs and operating costs that allows for higher gross margins.

Retailing Margins and the Apparent Price Spread

The retailing margin and the apparent price spread were calculated using data from table 1, BLS, and AMS. The net margins and operating costs from table 1 were allocated to processing and wholesaling costs (table 2). Costs for nonfluid products (cottage cheese, ice cream, and other products) were deducted from the processing and wholesaling costs.[3,4] Net margin and administrative costs were allocated across fluid and nonfluid processing and wholesaling costs. These costs provided us with the best estimate of both processing and wholesaling. Using the processing and wholesaling costs, farm value, assembly and procurement costs, and retail price for whole milk, we estimated a retailing margin and an apparent farm-to-retail price spread (difference between the retail price and the farm value).

The fluid milk retailing margin is the retail price (yearly average reported by the BLS) less processing and wholesaling margins, procurement and assembly costs, and the farm value. Assembly and procurement costs consist of the transportation costs of supplying milk to processors, laboratory and onfarm field service to assure quality, pickup at farms, receiving and unloading, and management of raw milk reserves. The farm value is the effective Class I milk price adjusted by the butterfat differential to 3.3-percent butterfat and transportation costs from the farm to the first plant (milk hauling charge).[5]

[3]Processor-distributors have deducted the nonfluid milk products' costs from processing costs. However, some processor-distributors may not have subtracted other product costs (ingredients used to make cottage cheese, ice cream, orangeade, and other products), and it is difficult to determine whether or not all other product costs have been separated from fluid milk processing.

[4]Wholesaling may include some nonfluid costs because some processor-distributors may have lumped together all delivery (wholesaling) costs for fluid and nonfluid products, since most processor-distributors have such low delivery costs for nonfluid products.

[5]This value is calculated using the milk hauling charge plus the effective overorder charge reported by Federal Milk Marketing Orders.

Evaluation of the Retailing Margin and Apparent Price Spread

To understand how the fluid milk retailing margin, wholesale costs, and processing costs compared with the rest of the food marketing industry, we compared these values with the aggregate food retailing, wholesaling, and processing indexes. Each value was expressed as an index with the base year equal to 1982-84. In 1990, the fluid milk retailing margin index (fig. 1) outpaced the aggregate food retailing index by 136 percent.[6] The fluid milk retailing margin was at an all-time high in 1991 at 36.9 cents per half gallon, more than doubling since 1987.

The fluid milk wholesale index in 1990 was below the aggregate food wholesaling index by 8 percent (fig. 2). The milk wholesaling index increased 10 percent in 1990, which could explain some of the growth in the apparent price spread. However, the milk wholesaling index changed little from 1983 to 1989. The growth in the price spread during this period apparently was not directly affected by the wholesale costs. The milk processing index in 1992 was 24 percent beneath the aggregate food processing index (fig. 3). The milk processing index has remained fairly stable since 1986, indicating that changes in the apparent price spread during the past 5 years were not due to changes in processing costs.

These two indexes suggest that milk wholesaling and processing costs were below the average of aggregate food wholesaling and processing costs when compared by indexes, and the effects of such costs on changes in the farm to retail price spread are minimal. With the milk retailing margin index outpacing the aggregate food retailing index and the retail whole milk prices at their peak in 1989 and 1990, the widening of the apparent price spread was due to charges at the retail level. Figure 4 shows the nominal and real apparent price spreads. The nominal apparent price spread was deflated using the Consumer Price Index for the whole economy to attain the real apparent price spread. The real spread declined from 1974 to 1983 and from 1985 to 1987. Between 1987 and 1991, the real spread increased. It decreased in 1992. It appears the significant rise in the nominal price spread was an attempt by retailers to recapture declines in the real price spread before 1987.

[6]As indicated (footnoted) in table 2, the retailing margin may include some wholesaling formerly performed by processors. This value may be slightly overstated, but its implications are significant.

Table 2--Fluid whole milk: Farm value, marketing spreads by function, and retail price per half gallon

Year	Marketing function					Retail price[2,6]
	Farm value[1,2]	Assembly and procurement[2,3]	Processing[2,4]	Wholesaling[2,4]	Retailing[2,5]	
	Cents					
1974	40.9	2.7	10.7	13.6	8.9	76.8
1975	41.2	2.8	11.4	13.6	7.9	76.9
1976	46.2	2.8	10.6	12.1	9.3	81.0
1977	45.1	2.9	13.2	12.6	8.3	82.1
1978	47.0	3.1	14.6	14.3	7.1	86.1
1979	52.2	3.8	15.1	16.6	8.3	96.0
1980	55.8	4.5	15.6	18.9	10.2	104.9
1981	59.5	4.7	16.0	19.1	12.4	111.7
1982	59.2	4.5	16.5	19.3	13.0	112.4
1983	59.5	4.3	16.6	17.8	14.6	112.8
1984	58.2	4.4	17.3	17.3	15.5	112.7
1985	56.1	4.8	18.6	17.8	16.1	113.4
1986	54.8	4.7	19.1	18.2	14.6	111.4
1987	56.1	4.9	19.1	18.0	15.6	113.7
1988	54.2	5.6	19.3	18.2	19.1	116.4
1989	59.0	5.5	19.2	18.4	24.8	126.9
1990	63.6	5.6	19.1	20.2	33.9	142.4
1991	54.0[7]	6.0	19.4	20.5	36.9	136.8
1992[7]	59.7	5.8	19.1	19.6	35.0	139.2

[1] Prices farmers received are normally quoted for 3.5-percent butterfat at plant of first receipt. This price has been adjusted for transportation from farm to first plant to get the farm price, then adjusted to get the value of milk containing 3.3-percent butterfat, the usual butterfat content at retail. There are approximately 23.3 half gallons of milk per 100 pounds.
[2] Values for 1985 through 1990 are revised.
[3] Nonfarm costs of supplying milk to processors, including laboratory and onfarm field service to assure quality, pickup at farms, transportation, receiving and reloading, and management of raw milk reserves.
[4] Data for processing and wholesaling are average costs for 30 fluid milk processor-distributor firms that represent moderate-sized, single-plant operations throughout the country. Very small plants and plants of retail food chains were not included.
[5] May include some wholesaling formerly performed by processors.
[6] Average of BLS monthly prices.
[7] Preliminary estimates.

The apparent fluid milk price spread index was lower than the aggregate food price spread index from 1985 until 1989 but then caught up and surpassed it in 1990 (fig. 5). In 1991, the apparent price spread index returned to the same level as the aggregate food price spread index and then fell below it in 1992. It seems that the price spread was making up ground in 1989 and 1990 that it had lost from 1985 to 1988. As indicated in the previous paragraph, milk wholesaling and processing costs have remained fairly constant since 1985. Figure 6 implies that the growth in the apparent retail price spread since 1985 occurred at the retail level. However, processors attained higher margins when the price spread was increasing and the farm value was declining during 1988-90, and thus, processors could be partly responsible for the increase in the apparent farm-to-retail price spread. The fluid milk price spread seems to have fallen back in line with other price spreads during 1992.

Figure 1

Comparison of fluid milk and all food marketing costs

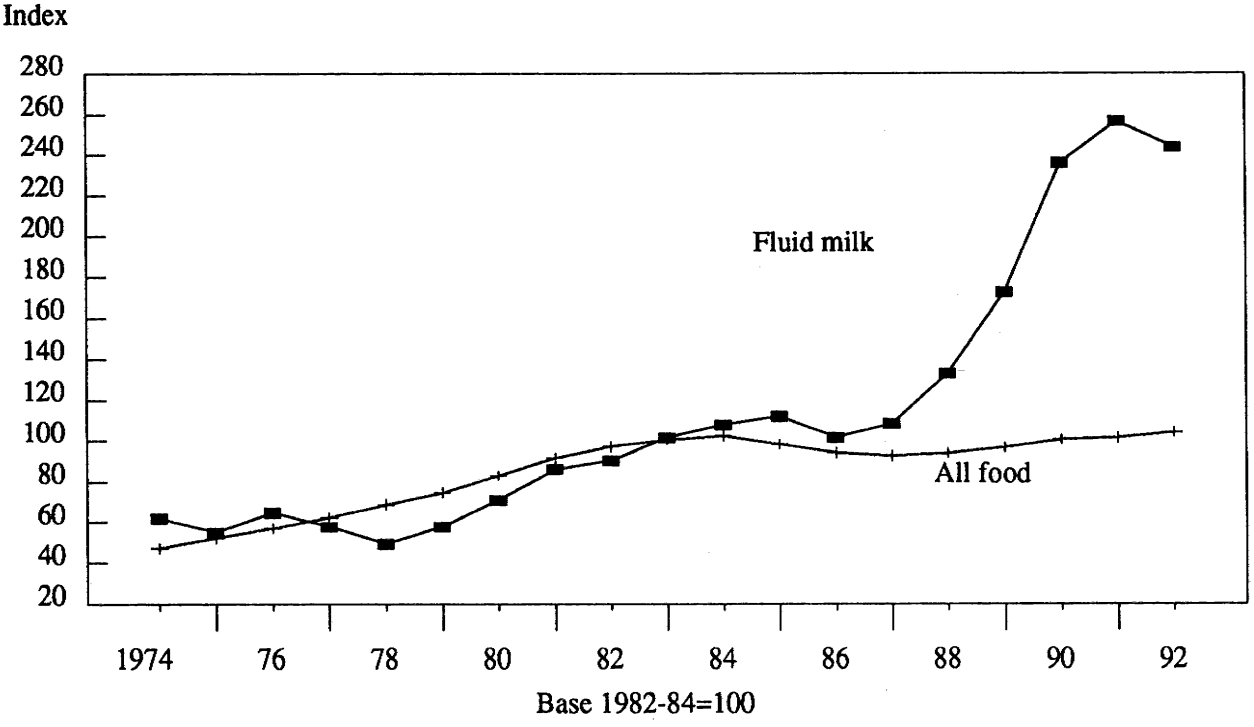


Figure 2

Comparison of fluid milk and all food wholesaling costs

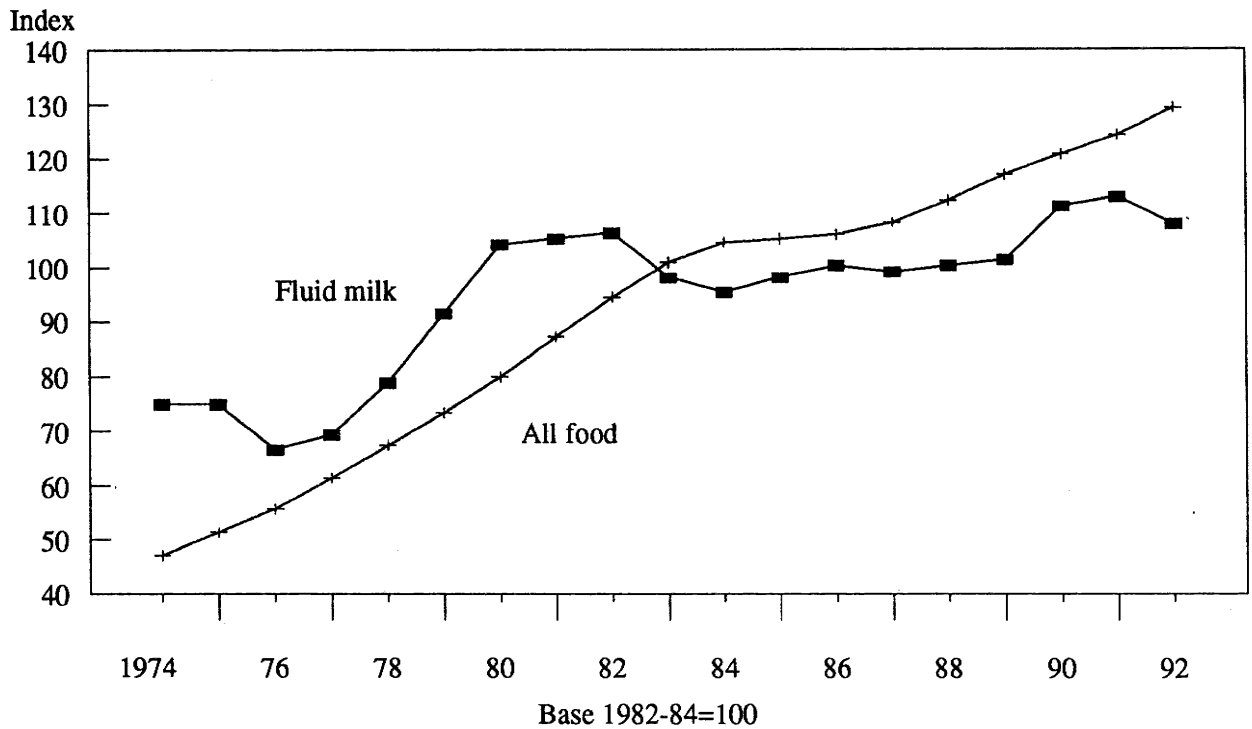


Figure 3

Comparison of fluid milk and all food processing costs

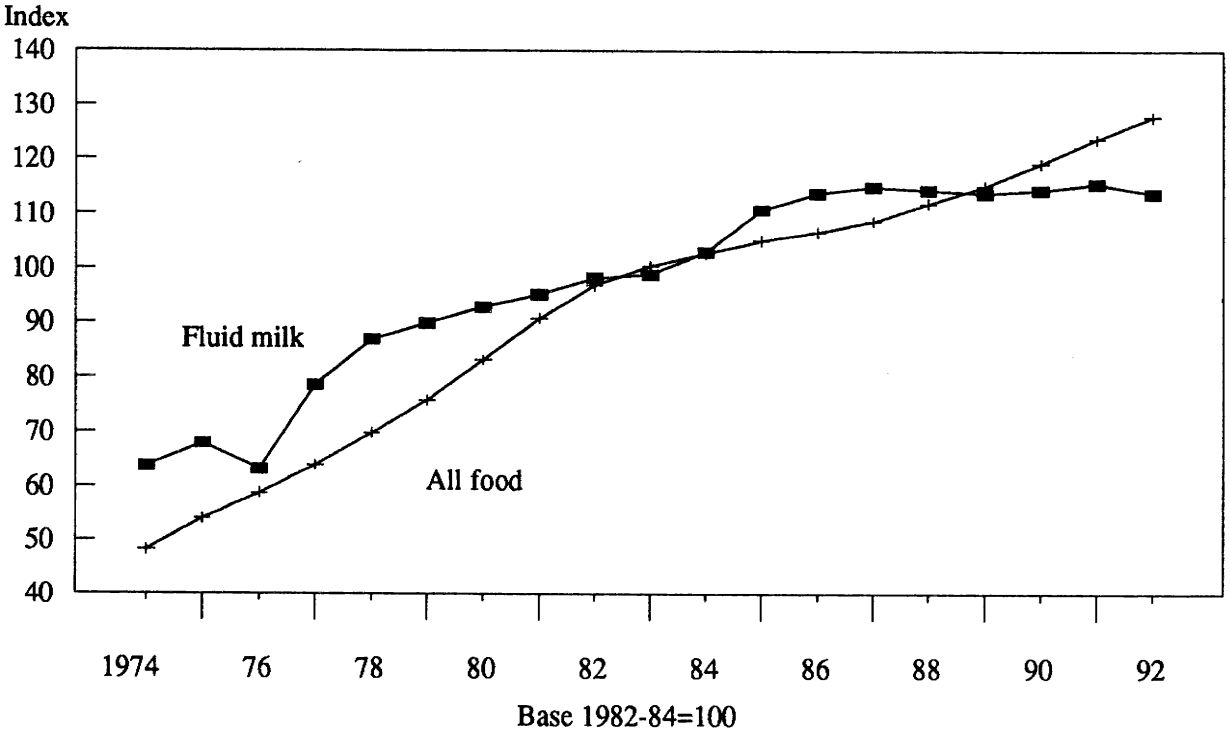


Figure 4

Fluid milk margins, in nominal and real terms

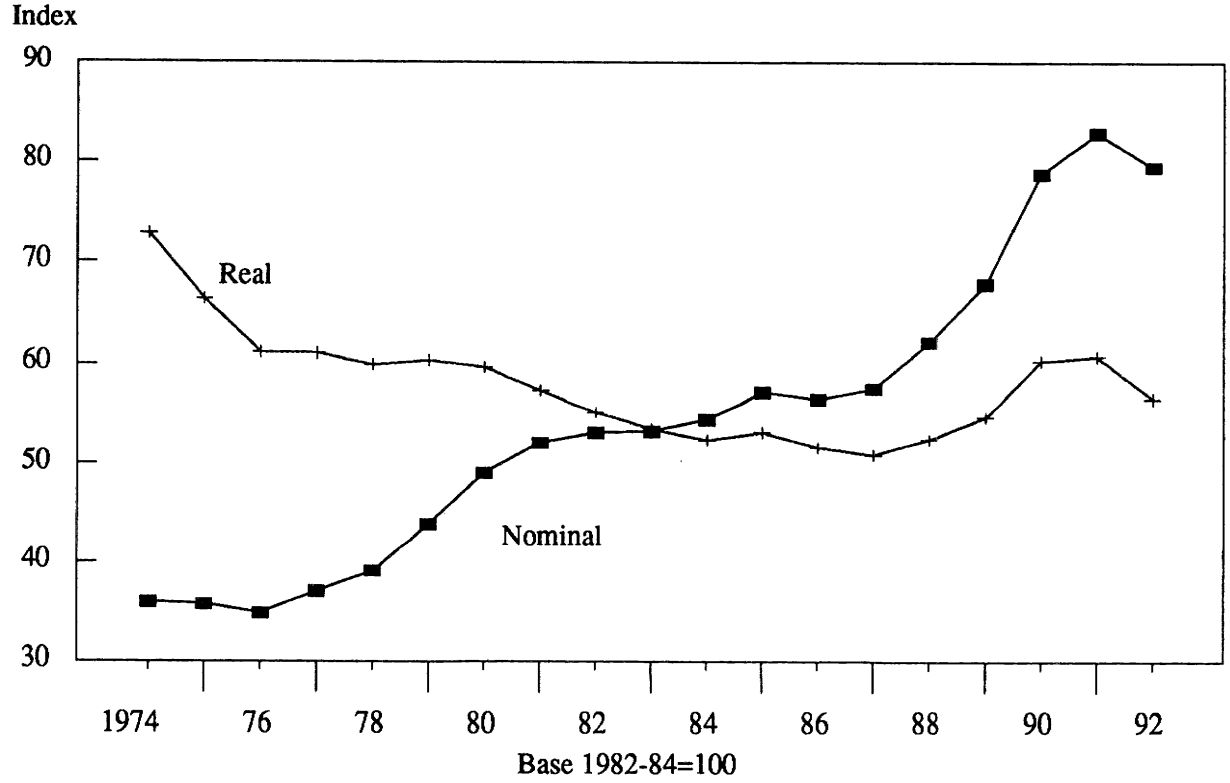


Figure 5

Comparison of fluid milk and aggregate food price spreads

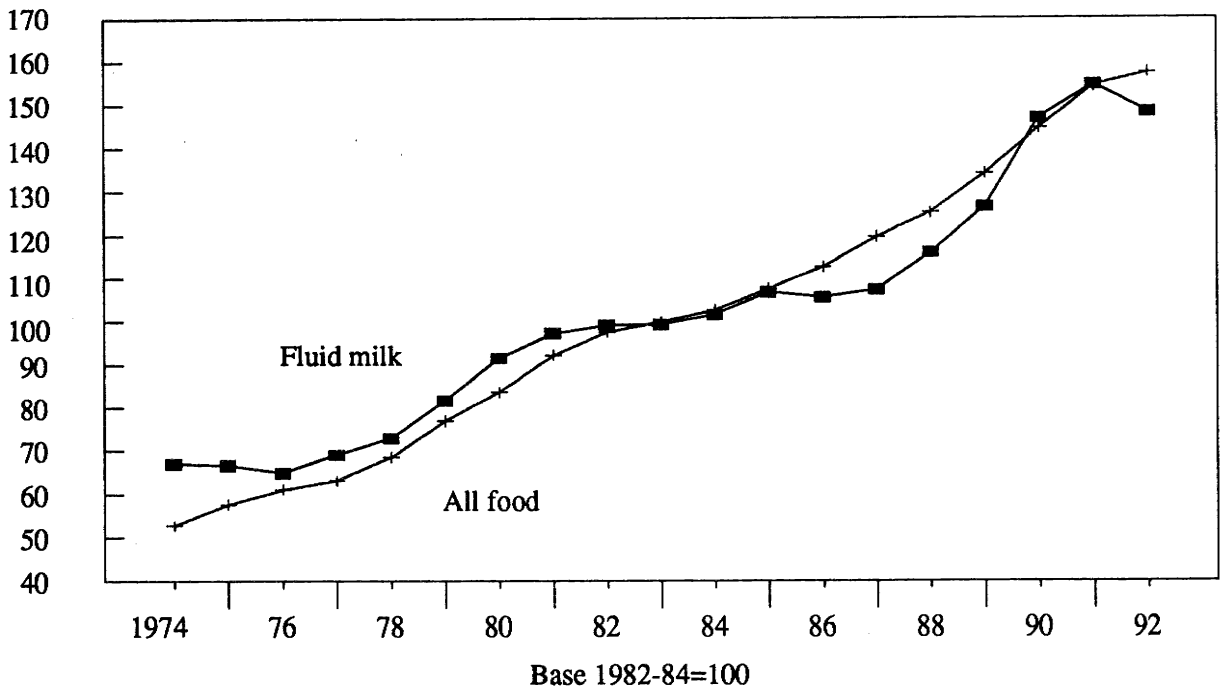
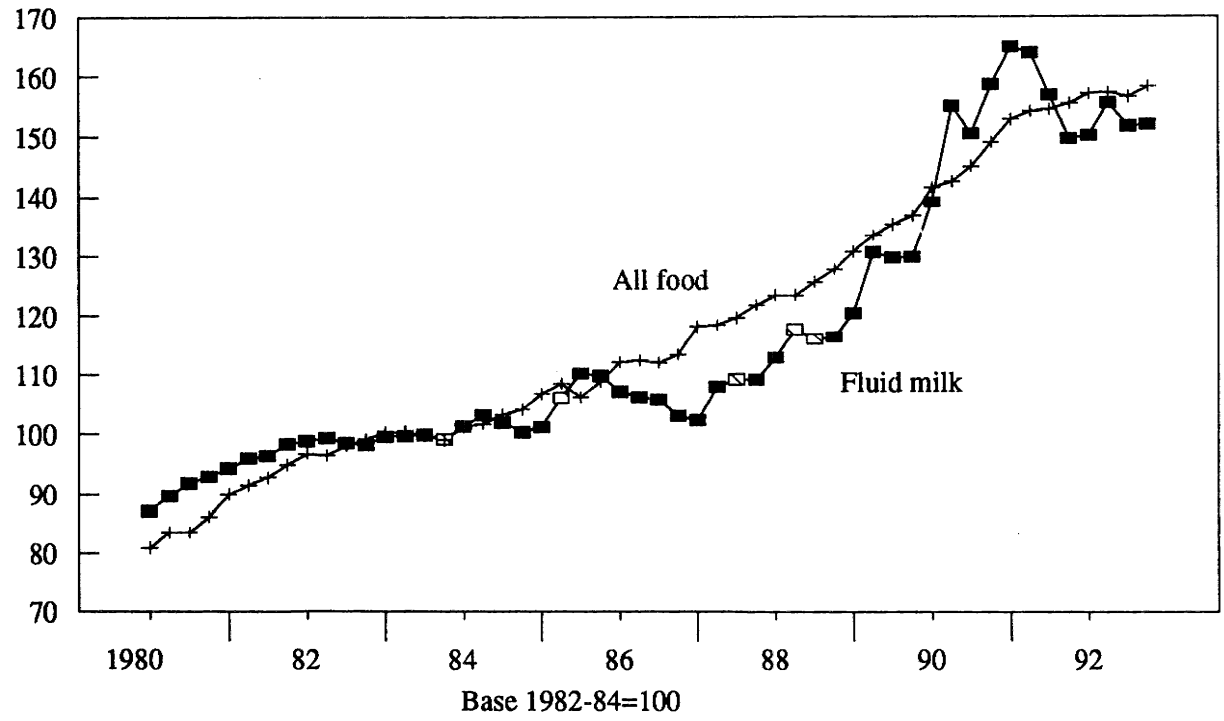


Figure 6

Quarterly fluid milk and all food price spreads



Fluid Milk Price Spread and Asymmetric Pricing

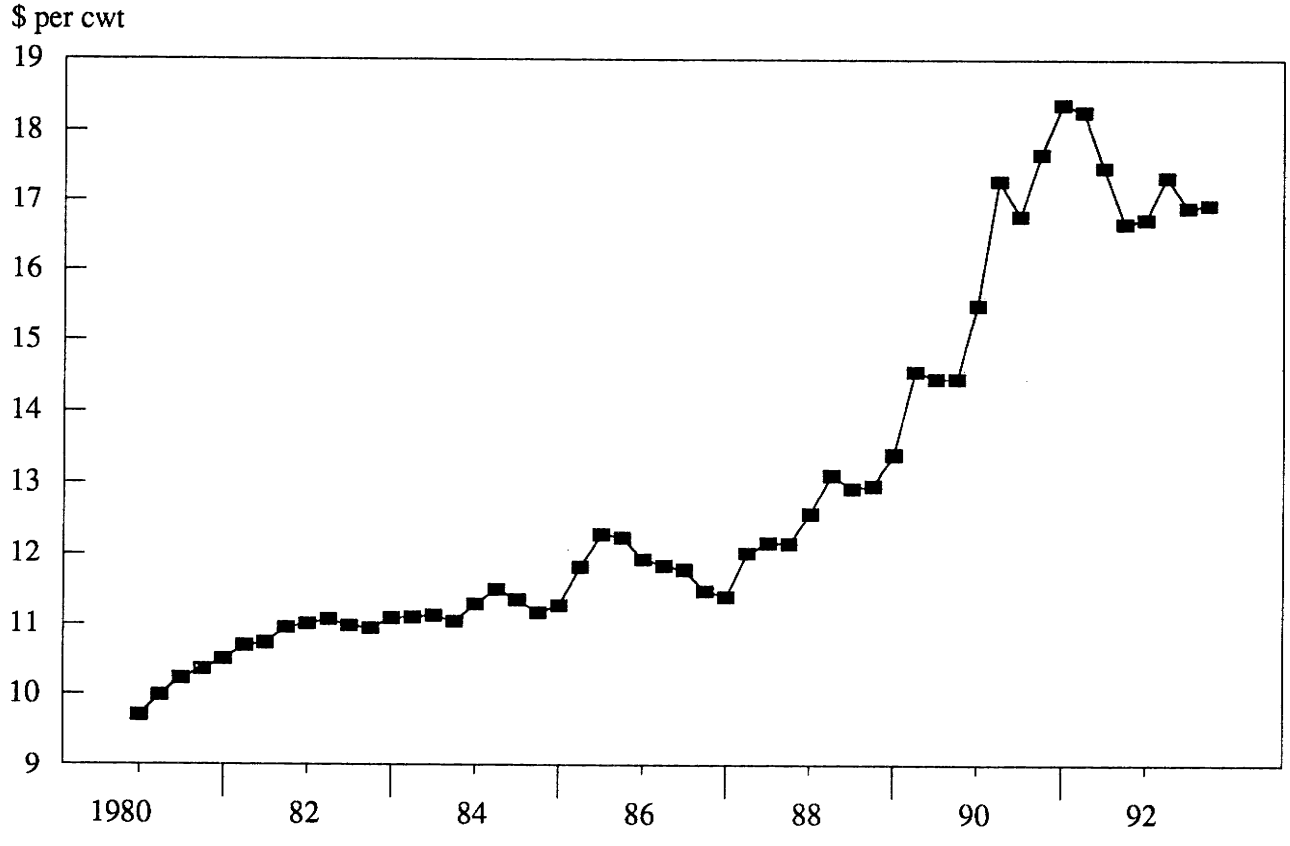
The effective Class I price spread--the fluid milk price spread--is shown in figure 7. This spread represents the cost of processing, procurement, assembly, distribution, and retailing. The Economic Research Service (ERS) calculates the fluid milk price spread for whole milk by the difference in the retail price and the effective Class I milk price on a cwt basis. The producer (farm) value is the weighted average effective Class I price reported by Federal Milk Marketing Orders. The retail price is derived from monthly data reported by the BLS based on retail prices in 91 areas. The spreads do not indicate costs or profits of processors and wholesalers, although they do indicate pricing movements within the dairy industry.

The fluid milk price spread increased $4.85 from 1988 to 1991. During this time, the producer price dropped 9 cents per cwt, while the retail price grew $4.76 per cwt. From 1980 to 1987, the price spread rose $1.92, the producer price grew 11 cents, and the retail price increased $2.03. Figure 7 shows rapid growth in the price spread during the first and second quarters of 1989, from the fourth quarter of 1989 to the second quarter of 1990 and from the third quarter of 1990 to the first quarter in 1991. During these periods, the producer price was decreasing (except for the fourth quarter of 1989), while the retail price was either growing or remaining relatively stable. Then, as retail prices began to edge down and farm prices began to recover in late 1991, the farm-to-retail price spread began to decline. The spread declined more than $1.00 per cwt between early 1991 (the peak spread) and late 1992.

Retailers have tended to react quickly to increases in farm milk prices by raising their own prices, although as the farm price declines, retail price adjustments tend to lag behind, not immediately passing on the lower farm price to consumers. This difference in price adjustments has been called asymmetric price adjustment (Hahn and Duewer).

Two varieties of asymmetric price adjustment can be distinguished. The least extreme type is purely a shortrun phenomenon. The shortrun type of

Figure 7
Effective Class I-to-retail price spread



asymmetric adjustment occurs, for example, when the longrun reaction of the wholesale price to a farm price decrease is exactly opposite from its reaction to a farm price increase. To continue the example, a permanent $1 increase in the farm price could cause a $1 increase in the longrun wholesale price, while a permanent $1 decrease in the farm price could cause a $1 drop in the longrun wholesale price. The longrun price adjustment in this case is symmetric. However, if it takes 1 month for the retail price to fully adjust to a farm price decrease and 3 months to adjust to a farm price increase, price transmission is asymmetric in the shortrun.

The second type is longrun asymmetry. In technical economic literature, this type of asymmetry is referred to as irreversibility. An example of irreversibility would be if a $1 increase in the farm price caused the longrun retail price to rise by $2, while a $1 drop in the farm price caused the retail price to drop by only $1. Irreversible price adjustment is the more extreme type of asymmetric price adjustment.

Research published by Kinnucan and Forker in 1987 demonstrated that the price transmission from farm milk to retail dairy prices was asymmetric. Kinnucan and Forker found that retail milk prices exhibited an irreversible adjustment pattern. Retail prices adjusted more rapidly and more completely to farm price increases than to farm price decreases.

Kinnucan and Forker's study did not determine the point in the marketing chain at which price transmission becomes asymmetric. The retail-to-farm price spread can be broken into two parts. The first is the farm-to-wholesale spread, and the second is the wholesale-to-retail spread. Price transmission asymmetry at one or both levels could explain the results found by Kinnucan and Forker. To determine the point in the marketing chain at which price transmission became asymmetric, quarterly data for the years 1983 to 1990 inclusive of farm Class I milk prices, wholesale fluid milk prices, and retail fluid prices were examined using statistical techniques similar to those used by Hahn (1989, 1990) in his studies of price transmission between farm, wholesale, and retail meat prices.

The statistical tests were set up on the premise that wholesale milk prices follow farm price changes and that retail milk prices follow wholesale price changes. This assumption of "markup pricing" has been used in many studies. Statistical tests show that wholesale prices exhibit shortrun asymmetric responses to farm price changes, while retail prices exhibit shortrun and irreversible price adjustment. Table 3 summarizes the adjustment path in the retail and wholesale prices implied by the estimates.

One interesting implication of these estimates is that the wholesale fluid milk price adjusts more rapidly to farm price declines than to farm price increases. One quarter after the farm price goes down by $1 per cwt, the wholesale price drops by $1.06. In contrast, it takes three quarters for the wholesale fluid milk price to adjust fully to a farm price increase.

The retail milk price takes longer to adjust to farm prices than the wholesale price because retail price movements are driven by wholesale prices. Consequently, the retail price cannot complete its adjustment until the wholesale price has finished reacting to farm price changes. When the farm price increases, the retail price of milk comes to equilibrium one quarter after the wholesale price has fully adjusted. It takes 10 quarters for the retail price to fully adjust to the wholesale price decrease caused by a farm price decrease. Also, the $1.06 rise in the wholesale price causes an estimated $1.73 increase in the retail price, while a similar drop in the wholesale price causes the retail price to drop only 92 cents.

Retail milk prices showed considerable asymmetric adjustment between 1983 and 1991, inclusive. The asymmetric adjustment of retail prices is one of the factors that has driven the widening of the farm-to-retail milk price spread. If this pattern of asymmetric adjustment continues into the future, we can expect a further widening of the price spread.

Table 3--Reactions of the wholesale and retail milk price to changes in the farm price of milk

Quarter	Farm price decreases $1 per cwt in quarter 1		Farm price increases $1 per cwt in quarter 1	
	Wholesale price adjustment	Retail price adjustment	Wholesale price adjustment	Retail price adjustment
	Dollars per hundredweight			
1	-1.07	-0.45	0.64	0.31
2	-1.06	-0.59	1.00	1.04
3	-1.06	-0.69	1.05	1.51
4	-1.06	-0.76	1.06	1.67
5	-1.06	-0.81	1.06	1.71
6	-1.06	-0.84	1.06	1.71
7	-1.06	-0.87	1.06	1.73
8	-1.06	-0.89	1.06	1.73
9	-1.06	-0.90	1.06	1.73
10	-1.06	-0.91	1.06	1.73
11	-1.06	-0.92	1.06	1.73
12	-1.06	-0.92	1.06	1.73

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