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AN ANALYSIS OF THE LEVEL AND DISPERSION OF RETAIL FLUID MILK PRICES IN TWENTY-FOUR UPSTATE AND EIGHT NEW YORK CITY MARKETS

Henry W. Kinnucan*

The dairy industry is the most important sector of the New York State agricultural economy. The cash value of all farm marketings in the State is approximately $2.2 billion and dairy product sales account for nearly 60 percent of this total (NYSDAM, 1980). The continuing viability of this important industry is crucially linked to the maintenance of consumer demand for dairy products. The long-term trend is not encouraging. Nationwide the milk-equivalent per capita consumption of all dairy products combined has declined continuously since the mid-1950s, although the rate of this decline has slowed somewhat in recent years. The major factor contributing to this downward trend is the declining per capita consumption of fluid milk items, which accounts for about 42 percent of total milk use. Over the past decade alone per capita fluid milk consumption has fallen off 5.7 percent in the U.S. (USDA DS-382). Over this same period, per capita milk consumption in New York declined 12 percent - nearly twice the national rate.

The aging of the population is probably the singlemost important factor explaining this secular decline in milk consumption (see, e.g., Salathe). Milk prices, however, are also potentially important. Boehm and Babb found the consumer highly responsive to milk prices when time is allowed for complete adjustment to a price change (their estimated long-run price elasticity for all fluid items was -1.63, the corresponding short-run estimate was -0.14). Given the apparent sensitivity of consumers to milk price changes, an improved awareness of the behavior of retail fluid milk prices in New York may improve our understanding of milk consumption trends in the State.

This study examines the behavior of retail fluid whole milk prices in 24 Upstate and eight New York City markets. Both the level and the dispersion of prices are analyzed.1/ Data collected regularly by the New York State Department of Agriculture and Markets (NYSDAM) serve as a basis for the analysis. An analysis of variance is applied to monthly data for the years 1970 and 1980 to determine what effects time, location, container size and store type (in the case of the New York City Area data) have on the average per ounce retail price of whole milk. In addition, analysis of covariance is used to determine the importance of market size (population) and market income in determining Upstate and New York City Area milk price levels.2/ Markets with relatively high or

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1/ Price dispersion is the range of prices charged for milk in a particular market and is defined as the difference between the lowest and highest price divided by the average market price times 100.

2/ Kmenta (pp. 409-23) provides a simple explanation of the analysis of variance and analysis of covariance procedures used in this study.

relatively low levels of milk price and milk price dispersion are identified. Further, changes in the relative rankings of the markets over time with respect to milk price and milk price dispersion are uncovered.

The study is organized as follows. First, the results of the analyses relevant to Upstate markets are presented. In this section, the results pertaining to price levels and those pertaining to price dispersion are discussed. Next, the analysis of the New York City Area data is discussed. Some comparisons between the Upstate and New York City findings are made and finally some conclusions are drawn.

Sources of Variation in the Level of Retail Fluid Milk Prices in Upstate New York

According to the milk price survey data, the average retail price of whole milk in the combined 24 Upstate markets during 1980 was 0.687 cents per ounce--ten percent lower than the corresponding 1970 price level (Table 1).3/ In 1970, Upstate consumers paid between 0.594-1.069 cents per ounce for milk. By 1980 this range had narrowed to 0.569-0.819 cents per ounce, indicating that inter-market differences in milk prices in Upstate markets have subsided over time.

Table 1. RETAIL MILK PRICE: SUMMARY STATISTICS[a]
24 Upstate New York Markets, 1970 and 1980

	1970	1980
	---------cents per ounce----------	
Mean Price	0.763	0.687
Standard Deviation	0.061	0.043
Price Range	0.594-1.069	0.569-0.819
No. of Observations	797	830

[a] Price data are deflated by the Buffalo area Consumer Price Index for all items (1967=100).

3/ All milk prices discussed in this section pertain to whole milk sold in foodstores and are expressed in terms of 1967 dollars. The appendix provides a listing of the markets and a sample sheet of the data source.

Container Size Effect on the Per Ounce Price of Milk in the Upstate Markets

The size of the container in which milk is sold is the most important factor in explaining the per ounce price variation for milk. Not surprisingly, the data indicate that in general milk is more expensive when it is purchased in smaller containers. For example, in 1970 milk purchased in quart containers was 14.4 percent more expensive (on a per ounce basis) than milk purchased in gallon containers (Table 2). Milk sold in half-gallon containers, while 4.5 percent more expensive than milk in gallon containers in 1970, was only one percent higher than the per ounce gallon price by 1980 and this latter difference was not statistically significant.

Table 2. AVERAGE PRICE PREMIUMS PAID FOR MILK IN QUART AND HALF-GALLON CONTAINERS RELATIVE TO MILK IN GALLON CONTAINERS[a]
24 Upstate New York Markets, 1970 and 1980

Container Size	1970 Price Premiums		1980 Price Premiums	
	(¢/oz.)	Percent	(¢/oz.)	Percent
Quart	0.103*	14.4	0.049*	7.3
Half-gallon	0.032*	4.5	0.007	1.0

[a] Per ounce milk price in gallon containers is 0.714¢ for 1970 and 0.668¢ for 1980.

* Indicates price statistically significantly different from gallon price at $p \leq .01$ level.

The declining per ounce price differentials over time between container sizes has occurred because of an uneven rate of decline in price across the various container sizes. Between 1970 and 1980 the price of milk in quart containers declined at nearly twice the rate (12.2 percent) as the price decline for milk in gallon containers (Table 3). The price of milk in half gallon containers declined at an intermediate rate of 9.5 percent.

Table 3. AVERAGE REAL MILK PRICE BY CONTAINER SIZE[a]
24 Upstate New York Markets, 1970 and 1980

Store Type	1970	1980	Change 1970-1980
	---cents per ounce--		percent
Quart	0.817	0.717*	-12.2
Half-gallon	0.746	0.675*	-9.5
Gallon	0.714	0.668*	-6.4

[a] Prices of whole milk sold in food stores in 1967 dollars.

* Indicates 1980 price statistically significantly different from corresponding 1970 price at $p \leq 0.05$ level.

Intermarket Differences in the Retail Price of Whole Milk--Upstate New York

The data reveal considerable intermarket differences in the average retail price level of whole milk in Upstate New York. In 1970, fifteen of the 24 markets had mean milk prices which were statistically significantly different from the Albany market (Table 4).4/ Of these 15 markets, seven markets (Batavia, Binghamton, Buffalo, Jamestown, Newburgh, Niagara Falls and Rochester) had mean milk prices significantly higher than the Albany price. Buffalo, the highest priced Upstate market in 1970, had a mean milk price 6.4 percent higher than the Albany price. Among the eight markets (Amsterdam, Auburn, Gloversville, Olean, Rome, Syracuse, Utica and Watertown) with mean milk prices significantly below the Albany price, Watertown had the lowest mean price - 8.1 percent below the mean Albany price.

By 1980 the number of markets with mean milk prices deviating significantly from the Albany mean price had dropped to nine. Only four markets (Buffalo, Niagara Falls, Jamestown and Rochester) had mean milk prices statistically significantly above the Albany mean price. All members of this group were also classified as "high-priced" in 1970, but in 1980 Rochester replaced Buffalo as the highest priced market, with a mean milk price 11.9 percent above the Albany mean price.

The markets with milk prices significantly lower than Albany in 1980 were Binghamton, Elmira, Ithaca, Syracuse and Watertown. Relative to 1970, Binghamton, Elmira and Ithaca are newcomers to this group. Binghamton, a "high-priced" market in 1970, was the lowest-priced market in 1980 with a mean milk price 8.6 percent below the mean Albany price.

4/ The Albany market is used as a basis for comparison because its average 1970 price level approximated the overall Upstate price of milk during 1970. Thus when the 1970 average milk price in a particular market is statistically significantly different from the Albany price we can interpret this as indicating a significant deviation from the average Upstate New York price.

Table 4. INTERMARKET DIFFERENCES IN RETAIL FLUID MILK PRICES 24 Upstate New York Markets, 1970 and 1980[a]

Market	Price difference relative to the Albany market:[b] 1970		1980	
	(¢/oz.)	percent	(¢/oz.)	percent
Amsterdam	-0.029*	-3.9	0.002	0.3
Auburn	-0.058*	-7.7	-0.009	-1.3
Batavia	0.038*	5.1	0.003	0.4
Binghamton	0.014*	1.9	-0.058*	-8.6
Buffalo	0.048*	6.4	0.051*	7.6
Elmira	0.013	1.7	-0.016*	-2.4
Gloversville	-0.019*	-2.5	0.006	0.9
Ithaca	0.002	0.3	-0.016*	-2.4
Jamestown	0.040*	5.3	0.040*	6.0
Johnstown	-0.012	-1.6	-0.004	-0.6
Kingston	0.009	1.2	-0.002	-0.3
Newburgh	0.020*	2.7	0.0	0.0
Niagara Falls	0.046*	6.1	0.050*	7.4
Olean	-0.046*	-6.1	0.010	1.5
Plattsburgh	-0.010	-1.3	-0.014	-2.1
Poughkeepsie	0.006	0.8	0.005	0.8
Rochester	0.029*	3.9	0.080*	11.9
Rome	-0.046*	-6.1	-0.005	-0.8
Schenectady	-0.009	-1.2	0.001	0.2
Syracuse	-0.022*	-2.9	-0.023*	-3.4
Troy	-0.004	-0.5	-0.002	-0.3
Utica	-0.026*	-3.5	-0.003	-0.4
Watertown	-0.061*	-8.1	-0.037*	-5.5

[a] Prices pertain to whole milk sold in food stores in half-gallon paper containers and are deflated by the Buffalo area Consumer Price Index for all items (1967=100).

[b] The mean Albany price 0.751¢/oz. and 0.671¢/oz. for 1970 and 1980 respectively.

* Indicates corresponding market price is statistically significantly different from the Albany price at $p \leq 0.05$ level.

In addition to significant intrayear market differences in retail fluid milk prices, the above analysis suggests that significant interyear changes have occurred in some markets. Indeed, while all 24 markets have experienced statistically significant reductions in real milk prices between 1970 and 1980, the

magnitude of these price decreases varied considerably across the markets (Table 5). Auburn, Olean and Rochester had mean real milk price reductions of less than five percent over this ten-year period. By contrast, the mean level of real milk prices in Binghamton declined 20 percent and Batavia, Elmira, Ithaca and Newburgh had price declines of 13 percent or more. The 14 percent price reduction in Elmira changed the price level ranking of this market from eighth in 1970 to twentieth in 1980. Ithaca experienced a similar change. Thus, while the average reduction in the real retail price of whole milk in half-gallon containers sold by food stores in the Upstate markets was 10.8 percent between 1970 and 1980, there was significant intermarket variation in the magnitude of this price reduction.

Table 5. MEAN REAL RETAIL LEVEL OF FLUID MILK PRICES
24 Upstate New York Markets, 1970 and 1980[a]

Market	Mean Price Level[b] 1970	1980	1970-80 Difference
	(¢/oz.)		(percent)
Albany	0.751	0.671*	-10.6
Amsterdam	0.722	0.673*	-6.8
Auburn	0.693	0.662*	-4.4
Batavia	0.789	0.674*	-14.6
Binghamton	0.765	0.613*	-19.9
Buffalo	0.799	0.722*	-9.6
Elmira	0.764	0.655*	-14.2
Gloversville	0.732	0.677*	-7.5
Ithaca	0.753	0.655*	-13.0
Jamestown	0.791	0.711*	-10.2
Johnstown	0.739	0.667*	-9.8
Kingston	0.760	0.669*	-12.0
Newburgh	0.771	0.671*	-13.0
Niagara Falls	0.797	0.721*	-9.5
Olean	0.705	0.681*	-3.5
Plattsburgh	0.741	0.657*	-11.4
Poughkeepsie	0.757	0.676*	-10.8
Rochester	0.780	0.751*	-3.7
Rome	0.705	0.666*	-5.5
Schenectady	0.742	0.672*	-9.4
Syracuse	0.729	0.648*	-11.2
Troy	0.747	0.669*	-10.5
Utica	0.725	0.668*	-7.8
Watertown	0.690	0.634*	-8.2

[a] Prices of whole milk in paper half-gallon containers and sold in food stores are deflated by the Buffalo Area Consumer Price Index for all items (1967=100).

[b] The mean Albany price 0.751¢/oz. and 0.671¢/oz. for 1970 and 1980 respectively.

* Indicates 1980 milk price is statistically significantly different from 1970 at $p \leq 0.05$ level.

Seasonal Effects on Upstate Milk Prices

Evidence of seasonal variation in Upstate New York milk prices in the 1970 and 1980 data examined in this study is nonexistent. Less than one percent of the total variation in the per ounce milk prices during 1970 and 1980 could be attributed to "month" effects and an F-test indicated that these effects were statistically insignificant. The same conclusion was reached whether the years were treated separately or combined. Seasonality tests for the individual markets were not conducted, therefore some markets may have seasonally varying milk prices even though all markets combined do not exhibit this characteristic.

Market Population and Income Effects on Upstate Milk Prices

The Upstate markets differ considerably according to population size and per capita personal income.5/ For example, in 1980 Buffalo, the largest Upstate market, had a population of 357,870 whereas Johnstown, the smallest market, had only 9,360 people. Similarly, the average 1978 per capita personal income (in current dollars) varied from $5,330 in Plattsburgh to $8,891 in Rochester.

To determine what effects, if any, market size and/or income have on Upstate retail fluid milk prices the following regression was estimated:

$$\ln P = \underset{(-10.5)}{-1.20} + \underset{(4.8)}{0.0009} \ln POP + \underset{(6.4)}{0.100} \ln Y - \underset{(-33.4)}{0.111} YR80$$

$$+\underset{(23.8)}{0.076} QRT - \underset{(-8.2)}{0.027} GAL \qquad R^2 = 0.63, \quad N = 1627$$

where ln P is the natural log of the real per ounce price of whole milk, ln POP is the natural log of the market population, ln Y is the natural log of the average per capita market income in 1967 dollars, YR80 is a dummy variable which assumes the value of one if the price observation pertains to 1980 and of zero otherwise, and QRT is a dummy variable which assumes the value of one if the price observation pertains to milk in quart containers and of zero otherwise, and GAL is a dummy variable which assumes the value of one if the price observation pertains to gallon containers and of zero otherwise. This regression "explains" 63 percent of the total observed variation in the Upstate real per ounce price of milk. All coefficients were statistically significant at the $p \leq 0.01$ level.

The coefficients of the variables of interest (income, population) are positive, suggesting that milk prices in Upstate New York vary directly with the income level and the size of the market population. The income coefficient indicates that a 10 percent rise in real per capita personal income would be associated with a one percent increase in the average real per ounce price of milk purchased by Upstate consumers, ceteris paribus. A similar rise in market population would result in only a 0.09 percent rise in per ounce real milk prices, ceteris paribus, according to the population coefficient. The smallness of the

5/ Population and income figures for the markets are provided in the appendix.

estimated population effect suggests that milk price declines associated with population loss will be minor even in markets experiencing significant population loss, such as Buffalo with a population decline of 22.6 percent between 1970-80 and Rochester with an 18 percent decline over the same period. Population, however, can be an important element in explaining intermarket differences in Upstate milk prices. For example, the 1980 Buffalo population exceeds the overall Upstate average population size by a factor of 4.8, therefore we would expect average milk prices in this market to exceed the Upstate average by 4.3 percent (0.009 x 480% = 4.3%) because of this population difference alone (the actual difference was about 11 percent).

Summary of Findings

From 24 Upstate New York markets 1,627 monthly price observations pertaining to the years 1970 and 1980 were analyzed. The substantive findings from this analysis are as follows:

- The 1980 real price of whole milk was lower than the corresponding 1970 level in all markets. While the average real price decline was 10.8 percent, significant differences in the rate of decline were observed among the markets. Most dramatic was the 19.9 percent price decline in the Binghamton market.

- Price premiums paid by Upstate consumers for milk in quart containers (relative to milk in gallon containers) narrows from 14.4 percent in 1970 to 7.3 percent in 1980; the price premiums for milk in half-gallon containers narrowed from 4.5 percent in 1970 to one percent in 1980.

- Buffalo and Rochester, the largest of the Upstate markets, were among the five highest priced markets in both 1970 and 1980.

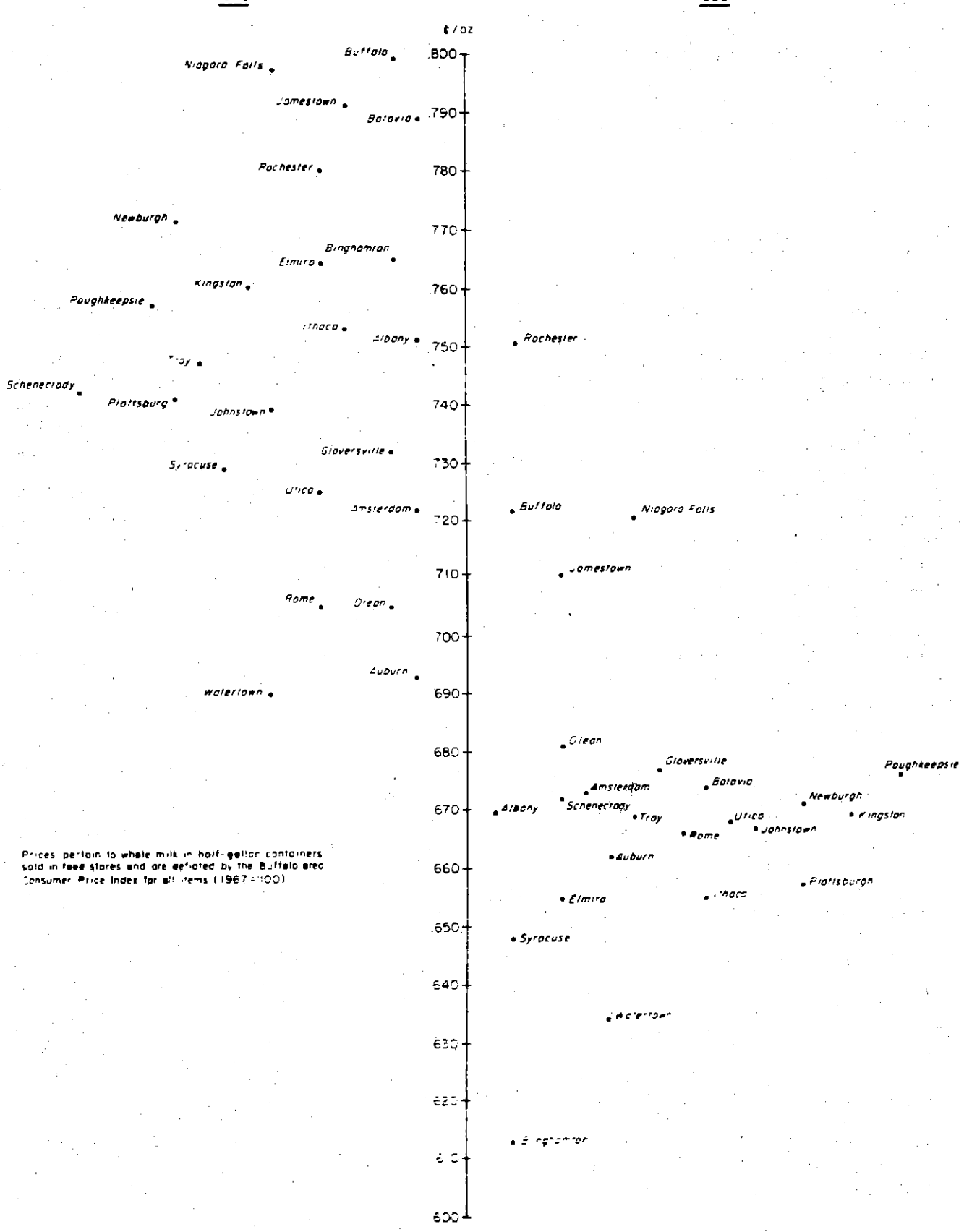
- Significant intermarket variation in retail fluid milk prices were observed in both years. In 1970 half-gallon milk prices ranged from 0.69¢ per ounce in Watertown to 0.80¢ per ounce in Buffalo. By 1980 this price range had widened to 0.61¢ per ounce in Binghamton to 0.75¢ per ounce in Rochester.

- No significant seasonal variation in milk prices was observed in the upstate markets during 1970 and 1980.

- There is some evidence that higher consumer incomes and/or larger markets are associated with higher milk prices in Upstate New York.

In addition to the overall decline and widening intermarket spread in real milk prices between 1970 and 1980, a tighter clustering of milk prices appears to have occurred (Figure 1). Whereas in 1970 the 24 markets were fairly evenly distributed throughout the distribution of milk prices, by 1980 the tails of the price distribution were more sparse and a greater concentration of markets around the average Upstate price was observed.

FIGURE 1. MEAN LEVEL OF RETAIL FLUID MILK PRICES IN 24 UPSTATE NEW YORK MARKETS, 1970 AND 1980



Finally, the effects of container size, year, market location, market population and market income, when considered together, explained only about 75 percent of the total variation in the real per ounce price of milk in Upstate New York. This suggests that other factors such as differences in, a) the competitiveness of the retail food sector, b) in milk quality, c) in the preference for milk and/or, d) in raw product costs among the different markets may be responsible for a significant portion of the unexplained intermarket price variation.

The Dispersion of Retail Fluid Milk Prices in Upstate New York Markets

In addition to being concerned with the level of retail whole milk prices, this paper also examines how the price ranges (the difference between the lowest and highest price observed in a market at a point in time) for milk in the different markets compare and how these price ranges have changed over time. The magnitude of the price range in a market for a relatively homogeneous product like milk is important because it provides some insight into how well the market is functioning from an economic standpoint. For example, according to an economic theory of information (Stigler) price dispersion provides a measure of how well consumers are informed in the market concerning price levels. A well-informed market, ceteris paribus, would have no price dispersion for a homogeneous product because consumers would always purchase the item from the store charging the lowest price according to this theory. The existence of a range of asking prices for a homogeneous product in a market at a point in time implies that (1) consumers do not feel it worthwhile to be completely informed about the existing distribution of prices (i.e., the marginal cost of discovering the lowest-priced source exceeds the marginal savings expected from engaging in price search), (2) transportation and time costs associated with purchasing the product from the lowest-priced source exceeds the savings gained therein, or (3) consumers do not view the product as being homogeneous, e.g., quality variations in the product (perceived or real) may exist.

The purpose of this section is to explore the intermarket variation in the intramarket dispersion of retail fluid milk prices charged by food stores for whole milk in the Upstate markets. Since grading and sanitation regulations render milk a fairly homogeneous product, the theoretical model of price dispersion discussed above seems to be an appropriate framework in which to interpret the results. Higher-than-average milk price dispersion would occur in markets where perceived quality variations in milk are relatively large, the opportunity cost of consumer's time is relatively high (so that complete price search is uneconomical), or store locations are widely dispersed. Price dispersion for the purposes of this analysis is measured as the price range divided by the average (or "prevailing") price times 100 and thus is expressed in terms of a percentage of the average price.

The New York State Department of Agriculture and Markets Retail Milk Price Survey data indicate that the average level of milk price dispersion across all 24 Upstate markets in 1980 was 7.3 percent and varied from zero to 32.3 percent (Table 6). Further, milk price dispersion, on average, appears to have lessened over time in the Upstate markets, dropping from an average of 13.6 percent in 1970 to 7.3 percent in 1980.

Table 6. MILK PRICE DISPERSION: SUMMARY STATISTICS[a]
24 Upstate New York Markets, 1970 and 1980

	1970	1980
	----------percent----------	
Mean Price Dispersion	13.6	7.3
Standard Deviation	9.0	6.8
Range	0-51.0	0-32.3
No. of Observations	797	830

[a] Price dispersion is measured as the market price range divided by the mean prevailing market price multiplied by 100.

Intermarket Differences in Milk Price Dispersion Among Upstate New York Markets

Intermarket differences, relative to the Ithaca market, in the dispersion of milk prices among the 24 Upstate markets for 1970 and 1980 are presented in Table 7.6/ An F-test indicates that the (null) hypothesis of no significant intermarket variation in the dispersion of retail fluid milk prices can be rejected at the $p \leq 0.01$ level in both years.

In 1970, fifteen markets had levels of milk price dispersion statistically significantly different from the Ithaca level. Of these 15 markets, eight had levels of price dispersion that exceeded the Ithaca level, the remaining seven markets had less milk price dispersion than Ithaca. Olean had the greatest level of milk price dispersion - 11.3 percentage points or 82 percent above the Ithaca mean level of 13.8 percent. The market with the least amount of milk price dispersion in 1970 was Jamestown, with an average price dispersion of 8.3 percent--40 percent less than Ithaca.

In 1980, the average level of milk price dispersion across the 24 Upstate markets had decreased 46 percent from 1970 to 7.3 percent, but intermarket variation increased--ranging from a low of 2.3 percent in Jamestown to a high of 25.6 percent in Batavia.7/ Seventeen of the 24 markets had levels of milk price dispersion significantly different from the Ithaca mean level, 13 of which were lower than Ithaca.

6/ The Ithaca market was chosen as the "comparison" market because its level of price dispersion more nearly matched the overall mean level of milk price dispersion observed across all 24 markets in 1970 and 1980.

7/ The Plattsburgh market is recorded to have the lowest level of milk price dispersion in 1980, but this may be due to the paucity of 1980 price observations for this market (seven) and therefore is ignored.

Table 7. INTERMARKET DIFFERENCES IN THE DISPERSION OF RETAIL FLUID MILK PRICES[a] 24 Upstate New York Markets, 1970 and 1980

Market	Price Dispersion Relative to the Ithaca Market:[b] 1970 Absolute Difference	1970 Percent Difference	1980 Absolute Difference	1980 Percent Difference
Albany	8.3*	60.1	-3.1*	-29.0
Amsterdam	4.7*	34.1	-5.1*	-47.7
Auburn	0.9	6.5	-3.7*	-34.6
Batavia	-4.9*	-35.5	14.9*	139.3
Binghamton	-1.5	-10.9	1.9*	18.7
Buffalo	-4.0*	-29.0	-0.4	-3.7
Elmira	1.3	9.4	-3.6*	-33.6
Gloversville	0.3	2.2	-6.0*	-56.1
Jamestown	-5.5*	-39.9	-8.4*	-78.5
Johnstown	3.5*	25.4	-6.9*	-64.5
Kingston	7.7*	55.8	6.8*	63.6
Newburgh	-0.3	-2.2	-5.0*	-46.7
Niagara Falls	-0.5	-3.6	-4.7*	-43.9
Olean	11.3*	81.9	-2.3	-21.5
Plattsburgh[c]	-2.7*	-19.6	-9.5	-88.8
Poughkeepsie	1.0	7.2	2.4	22.4
Rochester	-3.9*	-28.3	9.0*	84.1
Rome	-0.7	-5.1	-3.4*	-33.6
Schenectady	11.0*	79.7	-3.8*	-35.5
Syracuse	-3.6*	-26.1	2.5	23.4
Troy	10.8*	78.3	-4.1*	-38.3
Utica	8.5*	61.6	1.0	9.3
Watertown	-5.2*	-37.7	-3.8*	-35.5

[a] Price dispersion is measured as the per ounce price range divided by the per ounce price level multiplied by 100. These figures pertain to whole milk in half-gallons sold in food stores.

[b] The asterisk denotes that the level of price dispersion is significantly different from the Ithaca level of price dispersion at the $p \leq 0.05$ level. The Ithaca level of price dispersion was 13.8 percent and 10.7 percent in 1970 and 1980, respectively.

[c] Due to the paucity of 1980 observations (seven) a valid statistical test could not be performed for this market in that year. Similarly, the computed mean for 1980 is of questionable accuracy.

There appears to be considerable change over time in the relative rankings of the Upstate markets with respect to milk price dispersion. Of the six markets with the highest levels of milk price dispersion in 1970--Olean, Schenectady, Troy, Albany, Utica, Kingston--only one, Kingston, is in this category in 1980. Batavia, Rochester, Syracuse, Poughkeepsie and Binghamton displaced the rest. Similarly, among the six markets with the least amount of milk price dispersion in 1980 (discounting Plattsburgh--see Table 7, footnote c) only one--Jamestown--is so classified in 1980. Most spectacular in this regard is the changed ranking of Batavia from the third lowest in 1970 to the highest in 1980, i.e., from a 1970 level of milk price dispersion of 8.9 percent to a 1980 level of 25.6 percent.

Other Upstate markets undergoing significant change in the level of milk price dispersion between 1970 and 1980 can be discerned from Table 8. Eighteen of the 24 Upstate markets had levels of milk price dispersion in 1980 that were statistically significantly different from the corresponding 1970 levels. Of these 18 markets, only four--Batavia, Rochester, Rome and Syracuse--experienced increases in the level of milk price dispersion. Markets in which no significant change in milk price dispersion occurred are Binghamton, Buffalo, Kingston, Poughkeepsie and Watertown. Of the 14 markets undergoing significant reductions in milk price dispersion between 1970 and 1980 the most notable in terms of the magnitude of the reduction are Jamestown, Johnstown, Schenectady and Troy (all experienced a 70 percent or more reduction).

A better picture of the pattern of milk price dispersion among the Upstate markets as well as how this pattern has changed over time can be gleaned from Figure 2, which lists the markets according to their milk price dispersion levels in 1970 and in 1980. This figure illustrates the general downward trend in milk price dispersion occurring between the two time periods: in 1970 no markets had a level of milk price dispersion less than eight percent; by comparison, in 1980 milk price dispersion in 14 markets (over half of the 24 markets analyzed) had mean levels of milk price dispersion less than eight percent. Similarly, while in 1970 eight markets had levels of milk price dispersion which exceeded 16 percent, by 1980 only three markets retained this distinction.

Table 8. MEAN LEVEL OF MILK PRICE DISPERSION[a]
24 Upstate New York Markets, 1970 and 1980

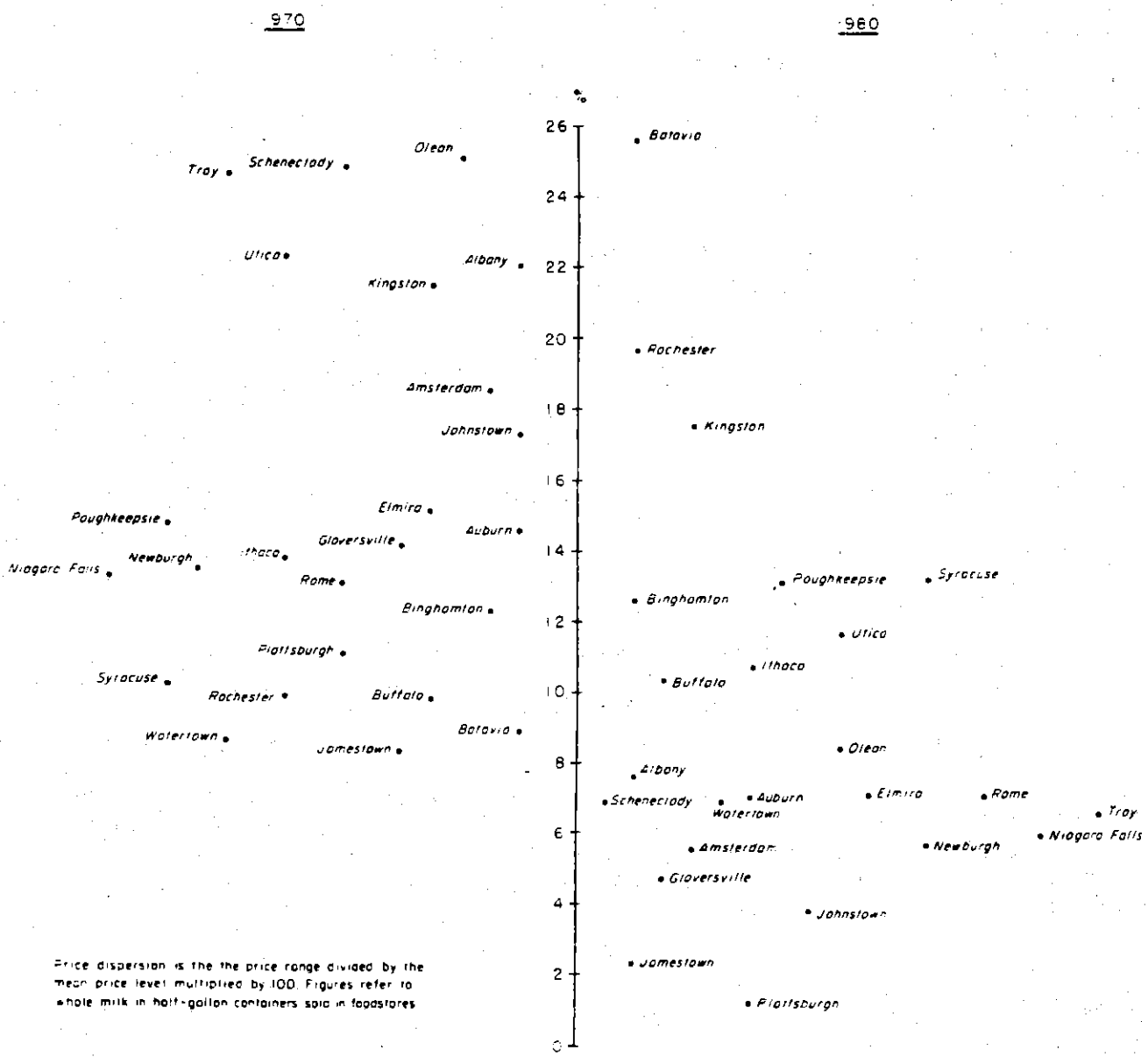
Market	1970	1980[b]	Change 1970-1980
	percent		
Albany	22.1	7.6*	-65.6
Amsterdam	18.5	5.6*	-69.6
Auburn	14.6	7.0*	-52.3
Batavia	8.9	25.6*	187.6
Binghamton	12.3	12.6	2.8
Buffalo	9.8	10.3	4.8
Elmira	15.1	7.1*	-52.9
Gloversville	14.1	4.7*	-66.3
Ithaca	13.8	10.7*	-22.4
Jamestown	8.3	2.3*	-72.3
Johnstown	17.3	3.8*	-77.9
Kingston	21.5	17.5	-18.8
Newburgh	13.5	5.7*	-58.0
Niagara Falls	13.3	6.0*	-54.7
Olean	25.1	8.4*	-66.5
Plattsburgh[c]	11.1	1.2	-89.2
Poughkeepsie	14.8	13.1	-11.2
Rochester	9.9	19.7*	99.2
Rome	13.1	7.1*	45.1
Schenectady	24.8	6.9*	-72.0
Syracuse	10.2	13.2*	29.2
Troy	24.6	2.6*	-73.0
Utica	22.3	11.7*	-47.4
Watertown	8.6	6.9	-20.4

[a] Price dispersion is measured as the per ounce price range divided by the per ounce price level multiplied by 100. These figures pertain to whole milk in half-gallon containers sold in food stores.

[b] The asterisk indicates that the 1980 level of milk price dispersion is statistically significantly different from the corresponding 1970 level at the $p \leq 0.01$ level.

[c] Paucity of the 1980 observations (seven) prevented a valid statistical test of significant difference.

FIGURE 2. MEAN DISPERSION OF RETAIL FLUID MILK PRICES IN 24 UPSTATE NEW YORK MARKETS, 1970 AND 1980



Price dispersion is the the price range divided by the mean price level multiplied by 100. Figures refer to whole milk in half-gallon containers sold in foodstores

Sources of Variation in the Level of Retail Fluid Milk Prices in New York City

In the eight New York City Area markets surveyed by the New York State Department of Agriculture, the average prevailing price of whole milk sold by chains, delicatessens and dairy stores in 1980 was 0.712 cents per ounce (Table 9).8/ This represents an 8.8 percent decline from the 1970 average price level of 0.781 cents. The price range for milk in 1980 was 0.582-0.894 cents per ounce compared with 0.632-1.032 cents per ounce in 1970.

Table 9. RETAIL MILK PRICE: SUMMARY STATISTICS[a]
Eight New York City Area Markets, 1970 and 1980

	1970	1980
	---------cents per ounce----------	
Mean Price	0.781	0.712
Standard Deviation	0.063	0.056
Price Range	0.632-1.032	0.582-0.894
No. of Observations	661	707

[a] Price data are deflated by the New York-N.E. New Jersey Consumer Price Index for all items (1967=100).

The within-year per ounce variation in milk prices described above is in part attributable to price differences associated with container size, type of store in which the milk is sold, the location of the store, i.e., market, and potential seasonal differences. The influence of each of these factors is discussed below.

The Influence of Container Size on the Per Ounce Price of Milk in New York City

In 1970, New York City consumers paid on average 13.6 percent more for milk in quart containers on a per ounce basis than for milk in gallon containers. The 1970 per ounce price premium for milk in half-gallon containers relative to milk in containers was 8.6 percent (Table 10). In 1980, the price premium for milk in quart containers, at 12.8 percent, was not much changed from the 1970

8/ Prices pertain to whole milk sold in paper quart and half-gallon containers and plastic gallon containers. All price data discussed in this section are deflated by the New York-N.E. New Jersey Consumer Price Index for all items (1967=100).

level, but the 1980 premium for milk in half-gallon containers was nearly one-half of its 1970 level (4.7 percent compared with 8.6 percent). By comparison, Upstate consumers paid about the same price premium (14.4 percent) for milk in quart containers but they paid a substantially smaller premium for milk in half-gallon containers (4.5 percent). In 1980, Upstate consumers paid smaller premiums for both container sizes (see Table 2).

Table 10. AVERAGE PRICE PREMIUMS PAID FOR MILK IN QUART AND HALF-GALLON CONTAINERS RELATIVE TO MILK IN GALLON CONTAINERS[a]
Eight New York City Area Markets, 1970 and 1980

Container Size	1970 Price Premiums[a]		1980 Price Premiums[a]	
	(¢/oz.)	Percent	(¢/oz.)	Percent
Quart	0.098*	13.6	0.086*	12.8
Half-gallon	0.062*	8.6	0.032	4.7

[a] The per ounce price of milk in gallon containers was 0.719¢ and 0.668¢ in 1970 and 1980, respectively.

* Indicates price differences statistically significant at the $p \leq .01$ level.

Statistically significant reductions in the real price of milk occurred across all container sizes in the New York City markets between 1970 and 1980 (Table 11).

Table 11. AVERAGE REAL MILK PRICE BY CONTAINER SIZE[a]
Eight New York City Area Markets, 1970 and 1980

Container Size	1970	1980	Change 1970-1980
	---cents per ounce--		percent
Quart	0.817	0.754*	- 7.7
Half-gallon	0.781	0.700*	-10.4
Gallon	0.719	0.668*	- 7.1

[a] Prices pertain to whole milk sold by chains, independents, and dairy stores and are expressed in terms of 1967 dollars.

* Indicates 1980 price significantly different from corresponding 1970 price at $p \leq 0.05$ level.

The sharpest rate of decline occurred for milk sold in half-gallon containers (10.4 percent). The price of milk in gallon and quart containers declined by 7.1 percent and 7.7 percent, respectively. When compared to the average rates of price decline experienced by the Upstate markets (see Table 3), the magnitude of the New York City Area price declines are about comparable for milk in half-gallon and gallon containers, but slower for quart containers (7.7 percent versus 12.2 percent Upstate).

The Influence of Store Type on Per Ounce Milk Prices in New York City

The New York City milk price data pertain to milk sold in three types of retail outlets: chain or supermarkets, independents or delicatessens, and dairy stores. The statistical analysis reveals that about 15 percent of the total variation in per ounce milk prices on the New York City markets in 1970 and 1980 can be explained by the influence of store type on milk price. In 1970, milk purchased from independents or delicatessens cost consumers, on average, 7.3 percent more than milk purchased from dairy stores (Table 12).

Table 12. AVERAGE MILK PRICE PREMIUMS BY STORE TYPE[a]
Eight New York City Area Markets, 1970 and 1980

Store Type	1970 Price Premiums		1980 Price Premiums	
	(¢/oz.)	Percent	(¢/oz.)	Percent
Chain or Supermarket	0.005	0.6	0.049*	7.4
Independent or Delicatessen	0.056*	7.3	0.072*	10.8

[a] Price premiums are relative to prices charged by dairy stores. The average dairy store price was 0.763¢/oz. and 0.668¢/oz. in 1970 and 1980, respectively. All money amounts are in terms of 1967 dollars.

* Indicates price significantly different from dairy store price at the $p \leq 0.01$ level.

Whereas in 1970 chains and supermarkets charged, on average, about the same price for milk as dairy stores, in 1980 chains and supermarkets charged 7.4 percent higher prices. The price premium paid for milk in independents and delicatessens increased to 10.8 percent (relative to dairy store prices) in 1980.

While average milk prices charged by each of the store types declined between 1970 and 1980, the rate of decline was uneven (Table 13). The slowest rate of decline (6.6 percent) occurred in chains and supermarkets. A somewhat faster rate of decline (9.6 percent) occurred in independents and delicatessens, with greatest price decline (12.4 percent) over the period occurring in dairy stores.

Table 13. AVERAGE MILK PRICE BY STORE TYPE[a]
Eight New York City Area Markets, 1970 and 1980

Store Type	1970	1980	Change 1970-1980
	---cents per ounce--		percent
Chain or Supermarket	0.768	0.717*	-6.6
Independent or Delicatessen	0.819	0.740*	-9.6
Dairy Store	0.763	0.668*	-12.4

[a] Prices pertain to whole milk and dairy stores and are expressed in terms of 1967 dollars.

* Indicates 1980 price statistically significantly different from corresponding 1970 price at $p \leq 0.05$ level.

The Influence of Market Location on the Per Ounce Price of Milk in New York City Area

Price differences attributable to market location explained about 22 percent of the total variation in real per ounce milk prices observed in the New York City area markets in 1970 and 1980. Intermarket differences are statistically significant at the $p \leq 0.01$ level in both years according to an F-test. In 1970, three markets (Bronx, Lower Eastside and Westchester) had mean milk prices significantly different from the Nassau-Suffolk County mean price (Table 14). The Bronx and Lower Eastside prices were lower and the Westchester County price was higher relative to Nassau and Suffolk County.

In 1980, intermarket differences in milk prices were somewhat greater than in 1970. The Lower Eastside, Flatbush-Bensonhurst-Borough Park, and Brighton Beach-Coney Island markets all had prices significantly above the Nassau-Suffolk County mean price. The mean milk price in the East New York-Williamsburg market was significantly lower than the Nassau-Suffolk County mean price, and the remaining markets--the Bronx, Jamaica, and Westchester County--had mean milk prices statistically equivalent to the Nassau-Suffolk price.

All eight markets, with the exception of the Lower Eastside, had significantly lower real milk prices in 1980 than in 1970 (Table 15). The most dramatic price declines occurred in Westchester County and the East New York-Williamsburg markets (14 and 12 percent price reductions, respectively). The other markets, with the exception of the Lower Eastside, experienced about a six percent real price reduction between 1970 and 1980.

Table 14. INTERMARKET DIFFERENCES IN RETAIL FLUID MILK PRICES
Eight New York City Area Markets, 1970 and 1980

Market	Price difference relative to the Nassau and Suffolk County market price:[a]			
	1970		1980	
	(¢/oz.)	Percent	(¢/oz.)	Percent
Bronx	-0.015*	-1.9	-0.004	-0.5
Lower Eastside	-0.032*	-4.0	0.015*	2.0
East New York and Williamsburg	-0.006	-0.8	-0.040*	-5.4
Flatbush, Bensonhurst, Borough Park	0.006	0.8	0.017*	2.3
Jamaica	-0.003	-0.4	-0.006	-0.8
Brighton Beach, Coney Island	0.002	0.2	0.013*	1.8
Westchester County	0.059*	7.4	0.0	0.0

[a] Price differences pertain to the December price of whole milk in paper half-gallon containers sold in supermarkets and chain stores, and are deflated by the New York-N.E. New Jersey Consumer Price Index for all items (1967=100). The Nassau and Suffolk County mean milk prices were 0.795¢/oz. and 0.735¢/oz. in 1970 and 1980, respectively. All money amounts are in terms of 1967 dollars.

* Indicates mean price significantly different from Nassau-Suffolk County mean price at the $p \leq 0.05$ level.

Table 15. MEAN LEVEL OF RETAIL FLUID MILK PRICES[a]
Eight New York City Area Markets, 1970 and 1980

Store Type	1970	1980	Change 1970-1980
	---cents per ounce--		percent
Nassau and Suffolk	0.795	0.735*	-7.5
Bronx	-0.780	0.731*	-5.9
Lower Eastside	0.763	0.750	-1.7
East New York and Williamsburg	0.789	0.695*	-11.9
Flatbush, Bensonhurst, Borough Park	0.801	0.752*	-6.1
Jamaica	0.792	0.729*	-8.0
Brighton Beach, Coney Island	0.797	0.748*	-6.1
Westchester County	0.854	0.735*	-13.9

[a] Prices pertain to the December price of whole milk in paper half-gallon containers sold in supermarkets and chain stores and are deflated by the New York-N.E. New Jersey Consumer Price Index for all stores (1967=100).

* Indicates 1980 mean price significantly different from the corresponding 1970 price at $p \leq 0.05$ level.

The differential rates of price decrease among the markets resulted in a shifting of the price ranking of the markets between the two years. In 1970, Westchester County had the highest average level of milk prices. By 1980, Westchester County shifted to fourth place, being replaced by the Flatbush-Bensonhurst-Borough Park market as the highest priced market. The Lower Eastside, which was the lowest priced market in 1970, was second highest in 1980.

Accompanying the price reduction between the two time periods was a narrowing of the range in real milk prices across the eight markets. In 1970, a price spread of 12 percent existed (0.763¢/oz. - 0.854¢/oz.); by 1980 this spread was about eight percent (0.695¢/oz. - 0.752¢/oz.).

Seasonal Effects on Per Ounce Milk Prices in the New York City Area

While the data suggested that on average milk prices were slightly higher during the months of December, January and February, than in the months of July and August, these differences in general were not statistically significant. Monthly differences explained only about three percent of the total observed per ounce variation in the New York City area milk prices during 1970 and 1980. Nor did seasonal milk price variation appear for any of the store types, i.e., when the data pertaining to chains and supermarkets, delicatessens and dairy stores were analyzed separately, no seasonal variation was uncovered.

Population and Income Effects on New York City Area Milk Prices

To establish what relationship, if any, the population density and income of the market had on milk prices in New York City, the following regression was run

$$\ln P = \underset{(-7.4)}{-0.50} - \underset{(-0.5)}{0.0010}\ \ln POP + \underset{(5.0)}{0.032}\ \ln Y - \underset{(-32.5)}{0.091}\ YR80$$

$$+ \underset{(18.2)}{0.058}\ QRT - \underset{(-17.0)}{0.063}\ GAL - \underset{(-15.4)}{0.054}\ DAIRY + \underset{(8.6)}{0.029}\ DELI,$$

$$R^2 = 0.68 \qquad N = 1368$$

where ln P is the natural log of the real per ounce price of milk, ln POP is the natural log of the number of persons per square mile residing in the market, ln Y is the natural log of the average per capita market income in 1967 dollars,9/ and the YR80, QRT, GAL, DAIRY and DELI variables are dummy variables indicating the year, container size and store type to which the price observation pertains (the intercept term contains the excluded category adjusted mean which is the 1970 price of milk in half-gallon containers sold by chains or supermarkets). The regression is based on 1368 observations and "explains" 68 percent of the variation in real per ounce milk prices.

The regression suggests that market population density had no significant influence on milk prices in New York City area markets. Market income appeared to be positively associated with milk prices: the t-ratio indicates that the income effect is statistically significant at the $p \leq 0.01$ level. The estimated elasticity is 0.032 which means that a ten percent increase in real per capita personal income would be associated with about a 0.32 percent increase in real per ounce milk prices, ceteris paribus. Given the relatively large differences in income across the New York City area markets, e.g., average per capita income in Westchester County in 1978 was nearly four times that of the East New York-Williamsburg market, this income effect on market milk prices can be an important factor in explaining intermarket differences in milk prices among these markets.

9/ See appendix for population and income data used in this regression.

Summary of Findings Relating to the New York City Area

The findings with respect to milk prices in the New York City area markets are summarized as follows:

- The mean real per ounce price of whole milk declined 8.8 percent between 1970 and 1980. The price of milk sold in paper half-gallon containers declined more sharply (10.4 percent) than milk in other container sizes. Milk sold by dairy stores had steeper price declines (12.4 percent) than milk sold by independents or delicatessens (9.6 percent) or by chains and supermarkets (6.6 percent).

- Price premiums paid for milk in smaller container sizes declined significantly between 1970 and 1980 for milk sold in half-gallons but not for quarts. On average, in 1980 New York City area consumers paid 12.8 percent and 4.7 percent more per ounce for milk purchased in quart and half-gallon containers, respectively, than for milk purchased in gallon containers.

- In 1970, chains and supermarkets charged about the same price for milk as dairy stores. However, by 1980 milk prices in chains and supermarkets were on average 7.4 percent above the corresponding dairy store price. The highest priced retail outlets were independents or delicatessens, charging price premiums of 7.3 percent and 10.8 percent in 1970 and 1980, respectively, for milk relative to dairy stores.

- New York City area markets differed significantly in terms of average prevailing milk prices. In 1980, Flatbush-Bensonhurst and Borough Park had the highest mean level of milk prices (0.752 cents per ounce in 1967 dollars) and East New York and Williamsburg had the lowest average level of milk prices (0.695 cents per ounce). The rate of change in milk prices over time varied among the markets also. In Westchester County real milk prices declined 14 percent between 1970 and 1980 whereas in the Lower East Side milk prices declined only 1.7 percent over the same period.

- There was no evidence of seasonal variation in the prices charged by the various retail outlets for milk.

- There was some evidence that retailers in higher income areas charged more for milk than retailers in lower income areas. Population density of the market appeared to have no effect on milk prices when the effect of income is held constant.

The Dispersion of Retail Fluid Milk Prices in the New York City Area Markets

In addition to intermarket variation in milk prices among New York City area markets, there appears to be significant differences within markets in the price charged for milk. In 1970 the average level of price dispersion (the price range divided by the average prevailing price times 100) for milk among the New York City area markets was 10 percent, but varied from zero to 36.4 percent (Table 16). By 1980 the average level of price dispersion had increased to 13.1 percent with a corresponding range of zero to 59.7 percent. The purpose

of this section is to explore the differences in milk price dispersion across the different markets and store types, and how the price dispersion has changed over time.

Table 16. MILK PRICE DISPERSION:[a] SUMMARY STATISTICS
Eight New York City Area Markets, 1970 and 1980

	1970	1980
	---------cents per ounce----------	
Mean Price	10.0	13.1
Standard Deviation	7.1	8.5
Price Range	0-36.4	0-59.7
No. of Observations	661	707

[a] The price range divided by the mean price multiplied by 100.

Milk Price Dispersion Across Store Types

Milk sold by dairy stores had significantly less price dispersion relative to milk sold by chains and supermarkets or delicatessens and independents (Table 17). Furthermore, this difference appears to have widened over time: in 1970 the average level of price dispersion for milk sold by supermarkets and chains was 11 percent compared with 8.3 percent for dairy stores; the corresponding figures in 1980 are 16.8 percent for chains and supermarkets and 6.5 percent for dairy stores.

Table 17. MEAN MILK PRICE DISPERSION[a] BY STORE TYPE
Eight New York City Area Markets, 1970 and 1980

Store Type	1970	1980	Change 1970-1980
	---cents per ounce--		percent
Supermarkets and Chains	11.0*	16.8*	52.7
Independents and Delicatessens	12.8*	16.6*	29.7
Dairy Stores	8.3	6.5	-21.7

[a] Price range divided by the mean price multiplied by 100. Figures pertain to whole milk sold in paper half-gallon containers.

* Indicates a statistically significant ($p \leq 0.05$) difference in price dispersion relative to dairy stores in the respective year.

In 1970, independents and delicatessens had slightly higher milk price dispersion than chains and supermarkets. By 1980 both store categories had higher but similar levels of milk price dispersion: milk price dispersion in chains and supermarkets increased 52.7 percent to 16.8 percent; the corresponding increase in independents and delicatessens is 29.7 percent to a level of price dispersion of 16.6 percent. By contrast, milk price dispersion in dairy stores declined from 8.3 percent in 1970 to 6.5 percent in 1980--21.7 percent reduction.

Intermarket Differences in Milk Price Dispersion

Intermarket variation in milk price dispersion was statistically significant in both 1970 and 1980 among the eight New York City area markets. In 1970 price dispersion in three markets were significantly different from the price dispersion in the Lower Eastside market: Jamaica's price dispersion was 32.8 percent higher, Bronx's was 41.8 percent lower, and Brighton Beach-Coney Island 46.3 percent lower than the Lower Eastside (Table 18). By 1980 Westchester County had the highest level of milk price dispersion among the eight markets--77.5 percent above the level in the Lower Eastside. The three other markets with significantly different levels of price dispersion (relative to the Lower Eastside) are Nassau and Suffolk (55.8 percent higher), the East New York and Williamsburg market (29.5 percent higher) and Bronx (19.4 percent higher).

Table 18. INTERMARKET DIFFERENCES IN THE DISPERSION OF RETAIL FLUID MILK PRICES[a]
Eight New York City Area Markets, 1970 and 1980

Market	Price dispersion difference relative to the Lower Eastside:[b]			
	1970		1980	
	level	percent	level	percent
Nassau and Suffolk	0.7	5.2	7.2*	55.8
Bronx	-5.6*	-41.8	2.5*	19.4
East New York and Williamsburg	0.0	0.0	3.8*	29.5
Flatbush, Bensonhurst, Borough Park	0.9	6.7	-1.9	-14.7
Jamaica	4.4*	32.8	0.5	3.9
Brighton Beach, Coney Island	-6.2*	-46.3	-1.5	-11.6
Westchester County	-1.2	-9.0	10.0*	77.5

[a] Price range divided by the per ounce price mean multiplied by 100. The Figures pertain to whole milk in paper half-gallon containers sold by chains or supermarkets.

[b] The average level of price dispersion in the Lower Eastside market is 13.4 percent and 12.9 percent in 1970 and 1980, respectively.

* Indicates price dispersion significantly different from Lower Eastside price dispersion in the corresponding year at the $p \leq 0.05$ level.

Between 1970 and 1980 the level of milk price dispersion changed significantly in all markets except the Lower Eastside (Table 19). Five of the eight markets had higher levels of milk price dispersion in 1980. Five of the eight markets had higher levels of milk price dispersion in 1980. The greatest rate of increase occurred in the Bronx, with a mean level of milk price dispersion of 7.8 percent in 1970 compared with a mean level of 15.4 percent in 1980. Milk price dispersion in Westchester County increased almost as rapidly as in the Bronx--from 12.2 percent in 1970 to 22.9 percent in 1980.

Milk price dispersion decreased significantly between 1970 and 1980 in two markets: Flatbush-Bensonhurst-Borough Park and Jamaica. The lowest level of milk price dispersion in 1980 (11.0 percent) occurred in the Flatbush-Bensonhurst-Borough Park market. Overall, however, the results indicate that, on average, milk price dispersion in the New York City markets has increased over time.

Table 19. MEAN LEVEL OF MILK PRICE DISPERSION[a]
Eight New York City Area Markets, 1970 and 1980

Store Type	1970	1980	Change 1970-1980
	percent		
Nassau and Suffolk	14.1	20.1*	41.8
Bronx	7.8	15.4*	97.4
Lower Eastside	13.4	12.9	-3.7
East New York and Williamsburg	13.4	16.7*	24.6
Flatbush, Bensonhurst, Borough Park	14.3	11.0*	-23.1
Jamaica	17.8	13.4*	-24.7
Brighton Beach, Coney Island	7.2	11.4*	58.3
Westchester County	12.2	22.9*	87.6

[a] Price range divided by the per ounce price multiplied by 100. Figures pertain to whole milk in paper half-gallon containers sold by chains or supermarkets.

* Indicates 1980 level of milk price dispersion statistically significantly different from corresponding 1970 level at the $p \leq 0.05$ level.

Some Comparisons Between the Upstate and New York City Area Milk Prices

The data analyzed in this paper indicate that the average prevailing price of whole milk sold by food stores was 3.5 percent higher in the New York City area markets than in the Upstate markets in 1970. By 1980 this differential had widened to 4.6 percent. This price differential may explain in part the higher levels of per capita milk consumption by Upstate consumers vis-a-vis New York City consumers.10/

The data indicate that consumers in New York City on average paid a larger price premium for milk in smaller container sizes than did Upstate consumers. In 1980, the price premium for milk in quart containers (relative to gallon containers) was 12.8 percent in New York City compared with 7.3 percent in the Upstate markets, and for milk in half-gallon containers 4.7 percent and 1.0 percent, respectively. These price relationships may reflect a greater preference among New York City area consumers for milk packaged in smaller containers.

No significant seasonal variation in retail milk prices was observed in either the Upstate markets or the New York City markets in either 1970 or 1980. This suggests that the retail market is insensitive to the underlying seasonal variations in the supply of and demand for milk.

Finally, the data indicate that the dispersion of milk prices has increased over time in the New York City area markets but has decreased over time in the Upstate markets. In 1970, milk sold in New York City area markets had 27 percent less relative price variation compared to milk sold in the Upstate market; by 1980 the New York City level of relative price dispersion was 80 percent higher than the Upstate average. This change occurred mainly because of lessening of price dispersion in the Upstate markets - from 13.6 percent in 1970 to 7.3 percent in 1980. To the extent that price dispersion is a reflection of market imperfections (see e.g., Stigler), these results suggest improvements in the overall functioning of Upstate markets over time with respect to retail milk marketing; the opposite conclusion would hold for the New York City area. Further research is needed to more fully understand why these shifts in milk price dispersion have occurred.

Limitations

The analysis presented in this paper is subject to a number of limitations. First, the conclusions pertain only to the price of whole milk. Price relationships for the lowfat and skim milks across the various markets may well be different from those found in this study for whole milk. Given the growing importance of lowfat milk in some markets, the prices of these beverages must be taken into account in any comprehensive attempt to determine intermarket differences in milk prices.

10/ A 1973 survey revealed that consumers in Albany and Syracuse drank about 60 percent more milk than New York City area consumers (Forker).

Secondly, this study is primarily descriptive: it makes no rigorous attempt to explain or justify the retail price differences that exist across the various markets. Certainly, some part of the intermarket price differences can be justified on the basis of differences in raw product costs. To the extent that these and other legitimate cost factors are operant, the results presented in this paper should not be construed to imply corresponding intermarket differences in milk marketing profitability. Foodstore operators in Rochester and Watertown may on average have similar profit margins for milk even though average retail prices for whole milk (in 1980) differ by 20 percent between the two markets.

A final qualification relates to the nature of the data. In an effort to arrive at some conclusion about the prevailing price of milk in various New York markets, the New York Department of Agriculture and Markets canvass the major retail milk outlets (usually 25 or 30 stores) in each market. Because the stores included in the survey are selected on the basis of their relative importance in the market (as deemed by the data collection agency) and not by rigorous scientific sampling procedures, the resulting data may contain some sampling bias. Therefore, one must be cautioned against concluding that the mean price levels computed in this study unequivocably represent the actual average price levels for fluid milk faced by consumers in the various markets. However, inasmuch as the direction and magnitude of the potential sampling bias is consistent across the markets, results pertaining to intermarket comparisons would not be altered to any significant degree.

Summary and Conclusions

With the above caveats in mind, the major findings of this study can be summarized as follows:

Upstate Markets - Milk Price Levels

- The 1980 average retail price of whole milk in foodstores when adjusted for inflation, was 10 percent lower than the corresponding 1970 price.

- Price premiums for milk purchased in smaller container sizes diminished significantly between 1970 and 1980. For example, in 1970 the per ounce price of milk in quart containers was 14.4 percent higher than the per ounce gallon price. By 1980 this differential narrowed to 7.3 percent. Similarly, the price premium for milk in half-gallon containers (relative to gallon containers) narrowed from 4.5 percent in 1970 to one percent in 1980.

- While the inflation-adjusted price of milk in all container sizes declined between 1970 and 1980, the rate of price decline varied by container size. The largest price decline occurred for milk in quart containers (-12.2 percent); next largest decline was for milk in half-gallon containers (-9.5 percent); and the smallest price decline occurred in milk sold in gallon containers (-6.4).

- In both 1970 and 1980, significant intermarket differences in the average level of retail milk prices among the 24 Upstate markets were observed. The price spread between the lowest- and highest-priced markets increased

from 16 percent in 1970 (Watertown .69¢/oz.; Buffalo .80¢/oz.) to 21 percent in 1980 (Binghamton .62¢/oz.; Rochester .75¢/oz.). The average level of milk prices across the 24 markets tended to be more uniform in 1980 than in 1970, i.e., the number of markets with milk prices differing significantly from the overall Upstate average dropped from fifteen in 1970 to nine in 1980.

- While all 24 Upstate markets registered a decline in the inflation-adjusted price of whole milk between 1970 and 1980, the rate of decline was uneven. The smallest price reductions occurred in Olean (-3.5 percent), Rochester (-3.7 percent), Auburn (-4.4 percent), and Rome (-5.5 percent). Markets experiencing particularly large price reductions between 1970 and 1980 are Binghamton (-19.9 percent), Batavia (-14.6 percent), Elmira (-14.2 percent), Ithaca (-13.0 percent) and Newburgh (-13.0 percent).

- When the 24 markets are taken as a whole, the 1970 and 1980 data show no evidence of seasonality in the average level of retail prices charged for whole milk in Upstate New York.

Upstate Markets - Milk Price Dispersion

- The average dispersion of retail milk prices in Upstate New York decreased from 13.6 percent in 1970 to 7.3 percent in 1980.

- Significant differences, both numerically and statistically, in the average level milk price dispersion among the 24 Upstate markets were observed in both 1970 and 1980. In 1970 milk price dispersion in six markets (Albany, Kingston, Olean, Schenectady, Troy, and Utica) exceeded 20 percent, i.e., the average range in prices for milk in these markets represented 20 percent or more of the average price level. In 1980 only Batavia and Rochester had a level of price dispersion of 20 percent or more. In 1970 the level of price dispersion in all 24 markets exceeded eight percent, whereas in 1980 fourteen markets had levels of price dispersion less than this figure.

- The average level of milk price dispersion in most Upstate markets decreased between 1970 and 1980 but there are some notable exceptions. Milk price dispersion in Batavia nearly tripled over this period--from nine percent in 1970 to 26 percent in 1980. Other markets experiencing relatively large increases in milk price dispersion over time are Rochester (99 percent increase), Rome (45 percent increase), and Syracuse (29 percent increase). Only five markets--Binghamton (13 percent), Buffalo (10 percent), Kingston (18 percent), Poughkeepsie (13 percent), and Watertown (seven percent)--had mean levels of milk price dispersion in 1980 that was not (statistically) significantly different from corresponding 1970 levels.

New York City Area Markets - Milk Price Level

- The average 1980 retail price of whole milk in New York City was 8.8 percent lower (when adjusted for inflation) than the corresponding 1970 price.

- In 1970 New York City consumers paid, on average, 13.6 percent more for milk (on a per ounce basis) purchased in quart containers than for milk purchased in gallon containers and this percentage price premium was about the same in 1980 (12.8 percent). The price premium for milk purchased in half-gallon containers (relative to milk purchased in gallon containers) declined from 8.6 percent in 1970 to 4.7 in 1980.

- The fastest rate of decline in the inflation-adjusted price of milk between 1970 and 1980 occurred for milk sold in half-gallon containers (10.4 percent). The price of milk sold in quart and gallon containers declined 7.7 percent and 7.1 percent, respectively.

- Whereas in 1970 chains and supermarkets in New York City charged about the same price for milk as did dairy stores, by 1980 they charged 7.4 percent more. Independents and delicatessens charged the highest price for milk; 7.3 percent and 10.8 percent greater in 1970 and 1980, respectively, than the corresponding dairy store prices.

- Between 1970 and 1980 the price of milk sold in dairy stores in New York City declined twice as fast (12.4 percent) as did milk prices in chains and supermarkets (6.6 percent). Milk prices in independent stores and delicatessens declined 9.6 percent over this period.

- Prices charged by the eight different markets within the New York City area for milk are not equivalent. In 1970, the lowest priced market was the Lower Eastside, with an average price for milk 11 percent less than the highest priced market--Westchester County. By 1980, the Lower Eastside was one of the highest priced New York City area markets with an average price eight percent above the lowest priced market--East New York and Williamsburg.

- Whereas all markets experienced a decline in real milk prices between 1970 and 1980, the rate of price decline across the markets is uneven. The largest price decline occurred in Westchester County (14 percent); the smallest decline in the Lower Eastside (1.7 percent). The remaining six New York City area markets had milk price declines of six percent or more.

- No significant seasonal variation in the retail price of milk in New York City was observed in either 1970 or 1980.

New York City - Milk Price Dispersion

- Milk price dispersion in New York City was greater in 1980 than in 1970 (13.1 percent vs. 10.0 percent). The opposite trend occurred in Upstate New York. Namely, milk price dispersion declined by nearly one-half between 1970 and 1980 (13.6 percent to 7.3 percent).

- Milk sold by dairy stores has the least amount of price variation (8.3 percent in 1970, 6.5 percent in 1980). Milk price variation in supermarkets and chains is about the same as in independents and delicatessens (1970 - 11.0 percent and 12.8 percent respectively; 1980 - 16.8 percent and 16.6 percent respectively). Milk price dispersion increased between 1970 and 1980 in all store types but dairy stores.

- Milk price dispersion across eight New York City markets in 1970 varied from 7.2 percent (Brighton Beach-Coney Island) to 17.8 percent (Jamaica). This compares to 1980 milk price dispersion ranging from 11 percent (Flatbush, Bensonhurst, Borough Park) to 22.9 percent (Westchester County). Milk price dispersion in the Bronx doubled between 1970 and 1980 (7.8 percent - 15.4 percent).

Milk is a fairly homogeneous product, yet considerable intermarket as well as intramarket variation in its price exists in New York State. This suggests that market imperfections are present with respect to the retail pricing of milk. One plausible source of market imperfection is suggested by the economic theory of information which states that price dispersion of a homogeneous product is a measure of consumer ignorance regarding price levels. Whether the existing distribution of retail fluid milk prices in New York State markets is attributable to this or to some other phenomenon can only be determined by further research.

The market does appear to be working fairly well with respect to the level of retail milk prices over time. The decade of the seventies can be characterized as a period of declining per capita demand for milk in the face of rising milk production. One would expect, given these circumstances, that milk prices would decline. The data indicate that the real milk price did indeed decline between 1970 and 1980.

To the extent that the price dispersion for milk found in this study can be generalized as being typical of food products in general, a case may be made in support of a publicly funded food price-reporting service that would inexpensively provide consumers with timely information (say through local newspapers) on the prices charged by different local food stores. Such a scheme was implemented on a trial basis in Ottawa, Canada and results appeared to have been favorable; consumers indicated a general satisfaction with the program and the benefits to society, net of losses to retailers, was estimated at $8,234 per month (Devine and Marion). More recently, Lesser and Bryant estimated that a food price publication program would increase market shares of identified low-priced stores by 4.5 to 16.5 percentage points. This suggests that markets exhibiting high levels of price dispersion could benefit from a program which enhances the public awareness of the existing distribution of prices.

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APPENDIX

POPULATION AND PER CAPITA PERSONAL INCOME, 24 Upstate New York Markets, 1970, 1978 and 1980.

Market	Population[1]		Per Capita Income[2]	
	1970	1980	1970	1978
			----dollars----	
Albany	115,781	101,727	4,478	8,138
Amsterdam	25,524	21,872	3,764	6,686
Auburn	34,599	32,548	3,450	6,485
Batavia	17,338	16,703	3,868	6,972
Binghamton	64,123	55,860	4,010	7,515
Buffalo	462,768	357,870	4,052	7,706
Elmira	39,945	35,327	3,754	6,806
Gloversville	19,677	17,836	3,411	6,195
Ithaca	26,226	28,732	3,600	6,606
Jamestown	39,795	35,775	3,518	6,776
Johnstown	10,045	9,360	3,411	6,195
Kingston	25,544	24,481	3,956	7,134
Newburgh	26,219	23,438	4,016	7,372
Niagara Falls	85,615	71,384	3,856	7,280
Olean	19,169	18,207	3,124	5,700
Plattsburgh	18,715	21,057	2,921	5,330
Poughkeepsie	32,029	29,757	4,309	8,163
Rochester	295,011	241,741	4,691	8,891
Rome	50,148	43,826	3,553	6,735
Schenectady	77,958	67,972	4,407	8,545
Syracuse	197,297	170,105	4,006	7,546
Troy	62,918	56,638	3,688	6,831
Utica	91,373	75,632	3,553	6,735
Watertown	30,787	27,861	3,415	6,381

1/ Source: U.S. Dept. of Commerce, Bureau of the Census, 1980 Census of Population and Housing Final Population and Housing Unit Counts, March 1981.

2/ Income pertains to the county in which the market resides. Source: State of N.Y. Dept. of Commerce, Bureau of Business Research, Personal Income in Areas and Counties of New York State 1978, Res. Bul. No. 48, August 1980, pp. 14 and 27.

POPULATION DENSITY AND PER CAPITA PERSONAL INCOME, 8 New York City Area Markets, 1970, 1978 and 1980.

Market	Population Density[1]		Per Capita Income[2]	
	1970	1980	1970	1978
	(persons per sq. mi.)		(dollars)	
Brighton Beach and Coney Island	27,898	23,908	2,577	4,591
Bronx	35,895	28,515	3,544	6,372
East New York and Williamsburg	74,400	63,761	1,800	3,206
Flatbush, Bensonhurst, and Borough Park	48,610	41,659	3,461	6,165
Jamaica	31,280	29,778	4,461	7,317
Lower East Side	119,631	110,898	2,344	4,079
Nassau and Suffolk	2,098	2,142	5,260	9,407
Westchester County	2,018	1,956	6,522	11,229

[1] The population figures for Bronx, Nassau and Suffolk, and Westchester counties are based on census counts obtained from U.S. Dept. of Commerce, Bureau of Census, 1980 Census of Population and Housing--New York, PHC80-V-34, March 1981. The remaining figures are derived by taking 1969 census tract counts pertaining to the respective areas (source: U.S. Dept. of Commerce, Bureau of Census, Census Tracts New York, New York SMSA, Part 2, PHC(1)-145, May 1972, tables P-1 and P-4) and dividing by the corresponding estimated land area. The 1980 figures were then derived on the basis of the population change of the county in which the market resides (e.g., Brighton Beach and Coney Island are in Kings County. The population in this county decreased 14.3 percent between 1970 and 1980. Hence, the 1980 population density for this 27,898 minus 14.3% equals 23,908).

[2] The income figures for Bronx, Nassau and Suffolk, and Westchester counties are from the NYS Dept. of Commerce, Bureau of Business Research, Personal Income in Areas and Counties of New York State 1978, Res. Bull. No. 48, August 1980. The remaining figures were derived using the same sources and procedures described in footnote 1.

SURVEY OF PRICES CHARGED FOR MILK ON RETAIL ROUTES, FOOD STORES AND DAIRY STORES 24 UPSTATE MARKETS FOR MAY 1980

Compiled by
Department of Agriculture and Markets
Division of Dairy Industry Services

FOOD STORE PRICES

	DOLLARS PER QUART		DOLLARS PER ½ GALLON		DOLLARS PER GALLON	
	Range	Prevailing Price	Range	Prevailing Price	Range	Prevailing Price
	(Paper)		(Paper)		(Plastic)	
CAPITAL DISTRICT						
Albany	.51 - .58	.51	.99 - 1.08	1.02	1.97 - 2.03	2.03
Amsterdam	.51 - .57	.53	NR	.99	NR	1.97
Gloversville	.53 - .54	.53	.99 - 1.02	.99	1.97 - 2.03	1.97
Johnstown	.51 - .53	.51	NR	.99	NR	1.97
Schenectady	.51 - .57	.52	.99 - 1.06	1.02	1.97 - 2.03	2.03
Troy	.51 - .55	.51	.99 - 1.03	1.02	1.97 - 2.03	2.03
CENTRAL NEW YORK						
Auburn	NR	.53	.96 - 1.03	1.01	1.99 - 2.05	1.99
Rome	.51 - .55	.51	.97 - 1.05	.97	NA	NA
Syracuse	.53 - .55	.53	.89 - .97	.95	1.75 - 2.01	1.75
Utica	.51 - .55	.55	.93 - 1.05	.97	1.87 - 1.97	1.97
SOUTHERN TIER						
Binghamton	.48 - .52	.49	.89 - .99	.89	1.77 - 1.99	1.83
Elmira	.51 - .55	.55	.89 - .95	.95	NR	1.85
Ithaca	.51 - .55	.51	.95 - 1.03	.95	1.89 - 1.99	1.89
HUDSON VALLEY						
Kingston	.57 - .65	.59	.99 - 1.19	.99	1.79 - 1.98	1.89
Newburgh	.53 - .55	.53	.99 - 1.01	.99	1.95 - 1.97	1.95
Poughkeepsie	.49 - .58	.56	.96 - 1.05	1.00	1.91 - 2.03	1.99
WESTERN NEW YORK						
Buffalo	.56 - .57	.56	.93 - 1.13	1.11	2.09 - 2.19	2.17
Niagara Falls	.55 - .57	.55	1.09 - 1.11	1.09	2.09 - 2.17	2.17
Rochester	.55 - .64	.58	.89 - 1.15	1.15	1.85 - 2.29	2.29
UNREGULATED AREAS						
Batavia	.43 - .55	.53	.77 - 1.07	1.03	1.69 - 2.08	1.93
Jamestown	NR	.57	NR	1.05	NR	2.05
Olean	.48 - .53	.53	.95 - .99	.99	1.87 - 1.99	1.99
Plattsburgh	.54 - .55	-	.98 - 1.00	-	1.93 - 1.99	-
Watertown	.47 - .49	.47	.93 - .99	.95	1.89 - 1.93	1.93

NR - No range
NA - Not available

SURVEY OF PRICES CHARGED FOR MILK AT FOOD STORES AND DAIRY STORES
IN THE NEW YORK CITY AREA

MAY 1980

(In Dollars)

	CHAIN OR SUPERMARKET		INDEPENDENT OR DELICATESSEN		DAIRY STORE PRICES	
	Range	Prevailing Price	Range	Prevailing Price	Range	Prevailing Price
(P denotes paper container & PL plastic container)						
AREA 1 NASSAU & SUFFOLK COUNTY						
Qt	.47 - .60 P	.57 P	.49 - .65	.63 P	.55 - .58	.56
½ Gal	.91 - 1.07 P	1.03 P	.91 - 1.13	1.03 P	.91 - 1.03	.97
Gal	1.77 - 2.13 PL	2.01 PL	NA	NA	1.90 - 2.00	1.95
AREA 2 BRONX						
Qt	.49 - .63 P	.58 P	.53 - .60	.58 P	.48 - .51	.50
½ Gal	.97 - 1.23 P	1.09 P	.99 - 1.19	1.12 P	.95 - .99	.97
Gal	1.89 - 2.26 PL	2.09 PL	2.09 - 2.19	2.13 PL	NA	NA
AREA 3 LOWER EASTSIDE NEW YORK						
Qt	.55 - .64 P	.57 P	.51 - .62	.58 P	NA	NA
½ Gal	1.05 - 1.24 P	1.15 P	1.00 - 1.15	1.09 P	NA	NA
Gal	2.09 - 2.34 PL	2.15 PL	1.97 - 2.15	2.11 PL	NA	NA
AREA 4 EAST NEW YORK & WILLIAMSBURG						
Qt	.50 - .59 P	.55 P	.53 - .62	.56 P	.49 - .50	.49
½ Gal	.89 - 1.10 P	.99 P	.95 - 1.10	1.05 P	NR	.93
Gal	1.81 - 1.99 PL	1.91 PL	1.87 - 2.05	1.99 PL	1.81 - 1.83	1.81
AREA 5 FLATBUSH, BENSONHURST, BOROUGH PARK						
Qt	.47 - .59 P	.57 P	.59 - .62	.60 P	NA	NA
½ Gal	.97 - 1.17 P	1.10 P	1.12 - 1.16	1.15 P	NA	NA
Gal	1.89 - 2.31 PL	2.15 PL	NA	NA	NA	NA
AREA 6 JAMAICA						
Qt	.54 - .59 P	.55 P	.55 - .69	.59 P	.52 - .55	.53
½ Gal	.99 - 1.19 P	1.07 P	1.05 - 1.15	1.09 P	.97 - 1.05	.97
Gal	1.99 - 2.09 PL	2.04 PL	NA	NA	1.89 - 1.99	1.90
AREA 7 BRIGHTON BEACH, CONEY ISLAND						
Qt	.53 - .58 P	.57 P	.55 - .61	.58 P	.55 - .58	.57
½ Gal	1.05 - 1.15 P	1.09 P	1.07 - 1.15	1.10 P	1.07 - 1.15	1.09
Gal	2.04 - 2.24 PL	2.05 PL	NA	NA	NA	NA
AREA 8 WESTCHESTER COUNTY (NEW ROCHELLE, LARCHMONT, MAMARONECK)						
Qt	.53 - .67 P	.58 P	.62 - .75	.67 P	.51 - .53	.53
½ Gal	.98 - 1.33 P	1.09 P	.85 - 1.49	1.10 P	.89 - .99	.97
Gal	1.83 - 2.15 PL	2.09 PL	1.59 - 2.20	1.89 PL	NA	NA

NP-No range
NA-Not available

PREVAILING PRICE FOR MILK IN QUART CONTAINERS 1/

(In Dollars)

	Food Stores	Retail Routes
New York Metropolitan (8 areas)	.568	NA
Upstate Markets	.536	.604
Average	.552	.604

1/ Prices are based on a survey of a sample number of stores & dealers by Department Inspectors.

DIS-1125