THE HOUSEHOLD DEMAND FOR MAJOR DAIRY PRODUCTS IN THE SOUTHERN REGION*

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Changing conditions in market organization and competitive nature of the United States dairy industry are signaling a different pricing system for milk and related products. Market conditions and demand patterns which led to adoption of the present pricing system no longer exist. The reservoir of manufacturing grade milk in Minnesota and Wisconsin is continually being depleted, as producers in that area either leave the business or shift to Grade "A" fluid outlets.

A changing demand for milk and other dairy products has also contributed to the present need for a reconsideration of the milk pricing process. Per capita consumption of beverage milk has stabilized at about 292 pounds per year. There have been, however, substantial increases in the consumption rate for some manufactured products, especially cheese. Ironically, with somewhat stabilized increases in population growth, future expansion for the dairy industry may rest with the potential for increased consumption of those products traditionally serving as "residual claimants".

As alternative pricing systems are considered, it is necessary to identify the current demand structure for specific dairy products. Consumption patterns and trends of major geographic regions are needed, as are estimated effects of variables such as income, household age/sex composition, educational level, race and other demo-graphic factors. The purpose of this paper is to present recent empirical evidence which facilitates identification of household demand structure for thirteen major dairy products in the U.S. South. Household panel data from the Market Research Corporation of America (MRCA) — made available by the United Dairy Industry Association (UDIA) — provide empirical observations needed for the study. Results obtained are summarized and compared to those from an earlier phase of the research which focused on aggregate U.S. demand for these same products. Since space precludes a complete discussion of all equations estimated, this paper's major emphasis is on comparing consumption and pricing patterns, estimated price and income responses and effects of selected demographic characteristics on quantities demanded. Results support the contention that dairy product consumption patterns in the U.S. South continue to be quite different from the U.S. average.

The remainder of this paper is divided into four sections. The following one presents and discusses statistical models. That section is followed by a brief description of how data are organized to obtain parameter estimates for two statistical models. Results are the presented. Finally, conclusions regarding industry policy are discussed.

STATISTICAL MODELS AND DATA

Two statistical models formed the analytical core for this research. One was based on cross sectional household data (Model A). It served as the basis for obtaining estimates of household consumption response due to income differences and to certain identifiable demographic characteristics. The model also provided an estimate of long-run response in consumption due to

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changes in retail price.[1] The general form of the model was as follows:

(2) Q = f(P, DV, HDV, ED, OCC, R, HES, CS, HC, INC),

where Q = aggregate quantity purchased by each consuming household during the

P = weighted average price paid by each consuming household for the most frequently purchased weight/volume package,

DV = percent of total volume purchased by each panel household while the product was "on deal"[2],

HDV = percent of the total volume purchased by each panel household from a home delivery distributor,

ED = education category of the household head,

OCC = occupational category of the househead,

R = race of the household, either white or non-white,

HES = employment status of the housewife, either employed or unemployed,

CS = population category of the city of residence,

HC = age/sex composition of the household, and

INC = annual household income.

Model A consisted of a set of 26 separate and independent equations, one for each of 13 different dairy products for all consuming panel households in the U.S., and separate equations for consuming panel households in the Southern region. Educational level of the household, occupation of its head, race, housewife employment status and city size were all entered into the equation as sets of zero-one variables. Percent of volume purchased from a home delivery distributor was only included as a variable for beverage milk products. The household's age/sex composition was specified by including as variables the actual number of members in each of nine age/sex classifications.[3] A second order polynomial was specified for the income variable, to permit identification of maximum household purchases as incomes increased. Parameter estimates for this model were obtained by an equation-by-equation application of ordinary least squares regression (OLS).

Since cross section data are static in nature and purchases are made by individual consuming units at one point in time, prices may legitimately be considered as predetermined. Thus, the single equation model of demand, with quantity specified as the dependent variable, is appropriate.

A second model (Model B) was also specified.[4] This one, based on a time series of market aggregates rather than individual household purchases, provided the best estimate of short-run market response to changes in a product's own price as well as to changes in weighted average prices of close substitute and/or complement dairy products. In addition, Model B permitted identification of certain seasonal consumption patterns. The general functional form of the model was as follows:

$Q = f(P_0; P_1, \ldots, P_n; P_{IDX}; DV; HDV; R; S)$

where: Q = aggregated per 1000 capita consumption for all panel households for each two week period,

P_0 = associated two-week weighted average price paid for aggregated panel purchases based on the most frequently purchased weight/volume package,

$P_1 \ldots P_n$ = weighted average price paid by panel households for n close substitute and/or complement products,

P_{IDX} = monthly Consumer Price Index for all foods adjusted to a two week basis,

[1] For Model A the terms "price elasticity" and "income elasticity" refer to average percentage change in household consumption rate of those households currently consuming the product, associated with a one percent change in retail price paid (or income) by those households consuming the product during the period of time under study. For Model B, "price elasticity" refers to the average percentage change in per capita consumption rate by all households, associated with a one percent change in a product's weighted average market price. These definitions, while somewhat confusing, serve to warn the reader that there is "probably no such thing as the elasticity of demand" for any of the products studied. Marshall's requirement that "all other things be held constant" can probably never be fulfilled in any empirical study of demand.

[2] Retail purchases made subject to special promotions or deals ("cents off", "coupon sale", "free gift", etc.) were reported by NCP households. The percent of the total volume purchased subject to such promotional considerations was then specifiec as an independant variable.

[3] Specifying the household as a collection of unit consumers for each product was also considered. This would have required a first round estimation of the scales themselves and methods of obtaining such scales often use total family expenditure, or total quantity consumed, as the dependent variable [1, 5]. These measures confound both a price and an income effect, however. The present formulation, number of members in nine age/sex groups, was felt to be at least superior to a simple "family size" variable.

[4] The specification of Model B closely resembles a model for meat estimated and reported in 1971 by Purcell and Raunikar [7].

DV = percent of the aggregate quantity purchased on deal for each two week period,
HDV = percent of the aggregate quantity purchased from a home delivery distributor,
R = geographic region, and
S = season of the year during which the purchases were made.

This model also consisted of a set of 26 separate and independent equations, one for each of 13 different dairy products for the U.S. total and separate equations for the Southern region. Following the MRCA convention, five geographic regions were specified: Northeast, South, North Central, Mountain and Southwest and Pacific regions. These were entered into the U.S. equations as zero-one variables. Season of the year was also specified as zero-one variable for each of three sixteen week periods; January-April, May-August and September-December. Parameters for this model were estimated by an equation-by-equation application of OLS.

The method of "seemingly unrelated regression," or Joint Generalize Least Squares (JGLS), was also applied to Model B equations. In cases where separate equations of a model were thought to be related through the disturbances, application of the JGLS technique has been shown to result in parameter estimators at least asympotically more efficient than those obtained by OLS [9]. However, disturbance inter-correlation among Model B equations was found to be relatively weak (ie., $< .30$), indicating that important gains in efficiency were not realized by estimating these product demands in a system.

Data

Data for empirical analysis were from the approximately 7500 MRCA National Consumer Panel (NCP) households.[5] More than 1.6 million individual dairy purchase records were originally available for the study. Data for most products were for April 1972-April 1973. Beverage milk and butter purchases were available through January 1974. Each purchase record contained a specific product type, its price, the quantity purchased, size and type of container, whether or not any special deal was involved in purchase and source of purchase (home delivered or retail). Demographic characteristics for the panel households were also available.

Two study samples were selected from the original 7500 households, one for each period of data availability. Households were included in the two samples if (a) they were active in the panel during the time period for which data were available and (b) they returned at least 95 percent of all possible weekly diaries. Approximately 5500 met these two criteria and were selected for the analysis of those products with data through April 1973. Of these 5500 households, 1043 lived in the Southern region.[6] A second sample, selected for analysis of butter and beverage milk product purchases contained about 5000 households. Southern region households accounted for 915 of them. Demographic characteristics of neither sample was impaired by eleminating those households without complete records.

Raw purchase data were aggregated in two ways. Data for the cross section model (Model A) were obtained by aggregating individual purchases of each sample household for the entire period of data availability, either 48 or 90 weeks depending on the product. Weighted average prices for the cross sectional model were obtained by dividing a household's total expenditure on each of thirteen products by the respective quantities purchased. It is important to note that only purchasing households were included as observations in Model A's individual regressions. Households did not report prices for those products not purchased. In addition, it was felt that including zero observations for, in some cases, up to 70 percent of the total sample would result in meaningless or misleading results. However, including all households with purchases greater than zero probably still confounded the actions of infrequent purchasers

[5]The United Dairy Industry Association (UDIA) acquired these data as a client of the Market Research Corporation of America and made them available for this research. Dr. G. G. Quackenbush, Director of Economic and Marketing Research of UDIA was instrumental in intiating research using the panel data and made significant contributions in all phases of the research.

[6]States included in the Southern region included: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia and West Virginia.

with regular consumers' adjustments of purchasing rate.

Data for the time series model (Model B) were obtained by summing, at two week intervals, purchases of all NCP households in each region. This market quantity was then divided by total number of persons in the regional sample and multiplied by 1000, to yield the per 1000 capita consumption rate for each two-week period. Prices for this model were calculated by dividing the two-week total expenditure on each product by the total quantity purchased.

RESULTS

Consumption Rates and Retail Prices

Southern regional consumption patterns and prices paid for thirteen selected dairy products are presented in Tables 1 and 2. In Table 1 annual consumption rates for consuming Southern households are compared with those for consuming households in the United States. Prices paid are simple averages of the weighted average prices paid by each household. Table 2 contains a comparison of average annual per capita consumption rates and prices paid. Per capita quantities, adjusted for a 12 month basis, are average two-week aggregate consumption figures for all sample households divided by sample population. Both consuming and non-consuming households are included. Prices paid are simple averages of weighted average prices obtained for each two weeks of the sample period.

Table 1. A COMPARISON OF ANNUAL CONSUMPTION RATES BY CONSUMING HOUSEHOLDS FOR THIRTEEN DAIRY PRODUCTS IN THE SOUTHERN REGION RELATIVE TO THE UNITED STATES TOTAL, 1972-73

Dairy Product	Unit	Southern Region			United States Total			Percent Difference 1/		
		Quantity Purchased	Average Price Paid in Cents	Percent Households Buying	Quantity Purchased	Average Price Paid in Cents	Percent Households Buying	Quantity Purchased	Average Price Paid	Percent Households Buying
Total Fluid Milk	half gallon	98.52 (103.80) 2/	65.30 (6.36)	98.97	123.95 (118.98)	60.28 (7.74)	98.77	-20.51	+8.32	+ .20
Regular Whole Milk	half gallon	75.36 (83.40)	66.05 (6.64)	98.14	85.92 (103.52)	61.17 (8.75)	95.04	-12.29	+7.98	+3.10
Two Percent Milk	half gallon	27.48 (63.96)	63.31 (9.22)	48.19	47.47 (79.02)	57.81 (9.34)	59.34	-42.11	+9.51	-11.15
Buttermilk	half gallon	9.27 (15.02)	65.53 (9.19)	55.84	5.57 (12.13)	63.58 (10.03)	43.23	+66.42	+3.07	+12.61
Ice Cream	half gallon	12.26 (14.65)	79.95 (25.14)	82.15	15.65 (17.57)	83.74 (30.56)	88.20	-21.66	-4.52	-6.05
Ice Milk	half gallon	9.53 (17.03)	54.70 (18.17)	51.60	6.88 (12.57)	64.00 (23.36)	36.07	+38.51	-14.53	+15.51
Nonfat Dry Milk	Pound	14.15 (22.58)	75.07 (13.04)	36.72	13.92 (27.00)	70.93 (16.00)	32.58	+1.65	+5.83	+4.14
Cottage Cheese	Pound	13.02 (18.73)	45.09 (9.83)	55.48	16.79 (20.43)	42.13 (8.21)	76.11	-22.45	+7.02	-20.63
Process Cheese	Pound	4.32 (7.22)	102.31 (14.83)	54.89	5.18 (7.69)	100.63 (16.86)	61.40	-16.60	+1.67	-6.51
American Cheese	Pound	6.53 (8.63)	113.04 (16.41)	65.08	7.27 (9.09)	113.42 (16.73)	72.23	-10.02	- .33	-7.15
Butter	Pound	6.12 (9.12)	86.88 (16.22)	41.42	11.41 (15.67)	83.41 (14.44)	58.73	-46.36	+4.16	-17.31
Canned Milk	13 oz. can	64.29 (105.70)	22.60 (6.20)	68.38	45.41 (87.94)	23.04 (7.29)	60.06	+41.57	-1.90	+8.32
Yogurt	half pint	17.64 (28.72)	27.72 (5.16)	22.01	21.74 (43.34)	25.48 (5.24)	29.29	-16.56	+8.79	-7.28

[1]Percent difference reports Southern region consumption relative to U.S. consumption.

[2]Standard deviations in parentheses.

Table 2. A COMPARISON OF ANNUAL HOUSEHOLD CONSUMPTION PER CAPITA FOR THIRTEEN DAIRY PRODUCTS BY HOUSEHOLDS IN THE SOUTHERN REGION RELATIVE TO THE UNITED STATES TOTAL, 1972-73

Dairy Product	Unit	Southern Region		United States Total		Percent Difference [1]	
		Quantity Purchased	Average Price Paid in Cents	Quantity Purchased	Average Price Paid in Cents	Quantity Purchased	Average Price Paid
Total Fluid Milk	half gallon	32.94 (1.03) [2]	64.06 (5.49)	40.08 (4.22)	59.14 (5.70)	-17.8	+8.32
Regular Whole Milk	half gallon	24.51 (1.07)	64.77 (5.71)	26.49 (4.76)	60.03 (5.63)	- 7.5	+7.89
Two Percent Milk	half gallon	4.32 (.48)	59.66 (4.92)	9.43 (5.15)	57.35 (5.31)	-54.2	+4.03
Buttermilk	half gallon	1.71 (.12)	64.22 (5.97)	.97 (.54)	62.22 (6.22)	+76.3	+3.21
Ice Cream	half gallon	3.89 (.42)	77.22 (2.15)	4.70 (.89)	77.91 (6.42)	-17.2	- .88
Ice Milk	half gallon	1.82 (.35)	50.68 (1.74)	.97 (.52)	60.67 (11.01)	+87.6	-16.47
Nonfat Dry Milk	half gallon	1.77 (.14)	67.60 (3.03)	1.70 (.32)	62.62 (3.81)	+ 4.1	+7.95
Cottage Cheese	Pounds	2.77 (.31)	42.04 (1.06)	4.62 (1.40)	40.24 (2.16)	-40.0	+4.47
Process Cheese	Pounds	.92 (.11)	97.46 (3.05)	1.12 (.28)	96.15 (3.69)	-17.9	+1.36
American Cheddar	Pounds	1.61 (.18)	110.02 (3.05)	2.10 (.85)	109.38 (5.00)	-23.3	+ .59
Butter	Pounds	.89 (.17)	89.09 (4.69	2.09 (.99)	83.57 (3.21)	-57.4	+7.10
Canned Milk	13 oz. can	6.23 (.58)	19.89 (.45)	4.07 (1.49)	19.80 (1.04)	+53.1	+ .45
Yogurt	half pint	1.47 (.35)	26.40 (1.20)	2.52 (1.53)	25.13 (2.05)	-41.7	+5.25

[1]Percent difference reports Southern region consumption relative to U.S. consumption.

[2]Standard deviations in parentheses.

It should be noted that Tables 1 and 2 show average consumption rates and prices paid from two quite different perspectives. Table 1 shows consumption rates of consuming households and average percent of all households buying, while Table 2 shows household consumption per capita. This does not distinguish between purchasing and non-purchasing households. Obviously, if the percent of all households buying was 100, the two figures would only differ by a constant, the average number of persons per household. The rather large standard deviations for quantities purchased in Table 1 indicate a rather wide variation in average household consumption rates at one point in time. In contrast, fairly low standard deviations for average per capita quantities indicate that aggregate purchases per capita are rather stable over time.

As evident from these tables, consuming Southern households generally purchased dairy products at rates substantially below the national average. Per capita consumption rates were also low. However, average prices paid were generally higher. Lower purchase rates were reported for all products except buttermilk, canned milk, ice milk and nonfat dry milk powder. Because of a somewhat higher percentage of all Southern households actually purchasing these products relative to the whole nation, resulting per capita consumption rates for these products were also higher in the Southern region.

Household consumption rates for the total fluid milk product averaged 20 percent lower in the Southern region than the United States average of 124 half-gallons. On a per capita basis, total fluid milk consumption in the home averaged .72 half-pints per day. The national average

for these data was .89 half-pints per person per day. While total fluid milk consumption was substantially below the national average, the average household consumption rate for regular whole milk in the South was only 12 percent below the national average. The shift to low fat milk, while accelerating nationally, appeared to be less dramatic in the South. This assertion was supported by a 40 percent lower Southern consumption rate — relative to the U.S. — for the two percent low fat product.

The reported consumption of nonfat dry milk powder in the South was slightly above the national average. Per capita consumption was 1.77 pounds of power per year, approximately 4.5 half gallons of fluid.

Consumption rates for manufactured products were also lower in the Southern region than nationally. Prices paid for these products were, however, high relative to the national average. As indicated previously, the major exceptions to this overall observation were consumption rates for canned milk and ice milk. Ice milk accounted for almost ⅓ of all frozen dairy deserts purchased

Table 3. A SUMMARY OF THE ESTIMATED INFLUENCES OF CHANGES IN PRICES AND HOUSEHOLD INCOME ON CONSUMPTION PATTERNS FOR THIRTEEN DAIRY PRODUCTS FOR THE SOUTHERN REGION AND THE TOTAL UNITED STATES, 1972-1973

Dairy Product	SOUTHERN REGION			TOTAL UNITED STATES		
	Price Elasticity[1]		Income Elasticity[2]	Price Elasticity[1]		Income Elasticity[2]
	Model A	Model B	(from Model A)	Model A	Model B	(from Model A)
Total Fluid Milk	-1.89*	-.65*	.15*	-1.63*	-.14	.05*
Regular Whole Milk	-1.45*	-.48*	.11	-1.70*	-.37*	-.07*
Two Percent Milk	-2.04*	-1.37*	.40*	-1.33*	-.55*	.16*
Buttermilk	-1.77*	-1.24*	-1.22	-1.52*	-1.77*	-.17*
Ice Cream	-.33*	-1.37*	.18*	-.42*	-.69*	.05*
Ice Milk	-.78*	-2.37*	-.03	-.56*	-1.06*	-.01
Nonfat Dry Milk	-3.36*	-1.07*	.20	-2.24*	-.45	-.02*
Cottage Cheese	-1.44*	-.63	.23*	-1.29*	-.43	.17*
Process Cheese	-2.02*	-4.91*	.25*	-1.71*	-1.80*	.12
American Cheese	-1.57*	-.97	.16*	-.44*	-2.17*	.16*
Butter	[3]	-1.55	[3]	-.76*	-.73*	.17*
Canned Milk	-1.51*	-.27	.24	-1.33*	[4]	-.34*
Yogurt	-1.86*	-.51	.43*	-.51*	-.36	.20

[1]Elasticities were calculated at the mean values for price, quantity and income variables.

[2]A second order polynomial term for income was also included as a variable in the model. However, results showed that the polynomial term contributed very little to the explanatory power of the equation. Therefore, unless the coefficient of the second order term was statistically significant at the 10 percent level, only the estimated coefficient from the first order income term was used to calculate the income elasticity.

[3]The F test for this equation indicated that the null hypothesis (All $\beta = 0$) could not be rejected.

[4]A positive own price effect was estimated and therefore is not reported.

NOTE: An asterisk (*) indicates that the estimated coefficient was statistically significant at the 10 percent probability level.

by households in the South. This compares with the national average of only 17 percent. Canned milk consumption on a per capita basis was 53 percent above the national average of 4.07 13-ounce cans per year. Hard cheese consumption in the Southern region was, however, somewhat lower than the national average.

The Influence of Price and Income Changes on Consumption

Table 3 contains the summarized results of the Model A and Model B parameter estimation for the effect on consumption of changes in retail price and annual household income. The elasticity estimates reported were calculated using the appropriate estimated coefficient and the mean values for the price, quantity and income variables.

Results of Model A

Summarized results of the Model A estimation indicated that households in the Southern region were generally more responsive to changes in retail prices and household incomes than households in the total United States. Southern households, paying a retail price for total fluid milk 10 percent higher than the mean price, purchased 18.9 percent less than those purchasing at the mean price. Estimated response for all U.S. households was 16.3 percent. This pattern generally held for all products except ice cream and regular whole milk. Interestingly, except for ice milk and buttermilk, those products with negative income elasticities for all U.S. households had zero or positive elasticities for Southern households.

Table 3 results also indicated that, in the long-run, households may be more responsive to changes in the retail price of fluid milk than short-run estimates from other studies have shown [3,8]. This finding was consistent with theory as well as with other cross sectional demand studies [6].

Household consumption rates for nonfat dry milk appeared quite responsive to different levels of retail price. In the Southern region, households purchasing nonfat dry milk (at prices 10 percent higher than the mean) purchased at rates 33 percent below the mean. Households in the total U.S. purchasing at the same level purchased only 22 percent less.

While cross section models are not ordinarily considered the best sources of data for estimating consumer response to changes in price, they may be the best available for obtaining estimates of long-run responses. If cross sectional observations (households) are not in the same market, so that observed (and reported) prices are different among consuming units, price response estimates indicate how consuming units in general might be expected to adjust to different levels of market price. With cross section data "disequilibrium among firms (households) tend to be synchronized in response to common market forces and ... many disequilibrium effects tend to work or appear in the regression intercept" [4, p. 208].

The reader is warned, however, that in the case of Model A estimates, the *ceteris paribus* assumption was probably seriously violated. Since households were not asked to report prices for products they did not purchase, it was not possible to separate the influence of other prices on consumption. It is unclear, however, whether the effect of other prices in demand equations would tend to lower or increase the magnitude of response to changes in own price level. In addition, spatial differences among households may give rise to climatic, cultural or other factors associated with variations in consumption rates, which are excluded from the model.

As expected, higher levels of income influenced increased purchases of yogurt more than other products for Southern households as well as the total U.S. Sourthern households with incomes 10 percent higher than the mean purchased at a rate four percent above those purchasing at mean price. For households in the U.S. the rate was only 2 percent.

Results of Model B

Table 3 also contains summarized results of the Model B estimation. As was the case with cross section results, consumers in the South were more responsive to price changes than were U.S. households generally. In only two cases (buttermilk and American cheese) was the calculated price response less elastic in the Southern region. The more elastic price responses estimated for Southern households were especially apparent for fluid milk products and nonfat dry milk powder. A 10 percent increase in average market price for fluid milk would result in approximately a 6.5 percent decrease in per capita household consumption for the Southern region. An estimate of the overall effect of such a price increase in the U.S. would imply only a 1.4 percent reduction in per capita

household consumption. Such results tend to add credence to the findings of a 1970 study by Bullion [2]. His results indicated retail price elasticities of $-.6$ to $-.7$ in the South, as compared to $-.25$ in the Upper Midwest and Northeast.

Demands for certain manufactured products also appeared to be quite responsive to changes in retail prices in the Southern region. This was especially true for process cheese, ice milk and butter.

Interpretation of these estimated individual price and income effects was, admittedly, somewhat tenuous. There was a rather high degree of intercorrelation among the explanatory variables, especially in the equations estimated for the Southern region. This would expectedly result in estimation of large standard errors for coefficients and in the confounding of individual effects.

Influence of Selected Demographic Characteristics

Table 4 contains the summarized results of the effect of household composition, race and education level of the head of the household on annual household consumption rates for selected dairy products in the South. The reader is cautioned that the results in Table 4 apply only to consuming households. This may be especially crucial when interpreting the influence of race on household consumption. While 20 percent of the households in the Southern region sample were black, only 12 percent of those households considered in this study were black. If consump-

Table 4. ESTIMATED COEFFICIENTS STANDARD ERRORS AND MEAN VALUES FOR SELECTED DEMOGRAPHIC CHARACTERISTICS WHICH INFLUENCE THE HOUSEHOLD CONSUMPTION RATE OF SELECTED DAIRY PRODUCTS IN THE SOUTHERN REGION OF THE UNITED STATES, FROM MODEL A, 1972-1973.

Product[1]	Mean Values	Household Composition[2]									Race[3]	Education[4]	
		Adult Male	Adult Female	Young Adult Male	Young Adult Female	Male 15-20 yrs.	Female 15-20 yrs.	Child 7-14	Child 2-6	Child less than 2		Grammar School Education	College Education
	.58	.78	.29	.32	.13	.11	.42	.15	.10	.12	.27	.26
Total Fluid Milk		25.27*	42.59*	40.36*	-30.35*	121.65*	-16.81	55.22*	44.58*	65.32*	-70.98*	6.22	-13.48
		(13.56)	(15.73)	(14.45)	(18.50)	(13.86)	(14.57)	(6.80)	(13.97)	(17.34)	(16.53)	(13.37)	(13.39)
Regular Whole Milk		15.42*	8.71	19.30*	-16.03	92.33*	-12.17	47.68*	25.14*	59.20)	-47.06*	-.04	-17.75*
		(11.35)	(13.44)	(13.67)	(15.68)	(11.42)	(12.13)	(5.60)	(11.57)	(14.24)	(13.74)	(11.13)	(11.12)
Two Percent Milk		-2.53	49.39*	.88	6.87	25.83*	7.68	14.24*	49.82*	-7.70	-23.49	20.17*	17.24*
		(13.38)	(16.62)	(16.26)	(22.00)	(13.51)	(14.59)	(7.72)	(14.15)	(17.67)	(18.94)	(14.16)	(13.23)
Buttermilk		2.15	12.13*	2.75	4.31	8.73*	-1.19	4.63*	-2.15	1.19	.05	7.08*	4.42
		(2.94)	(3.50)	(3.84)	(4.08)	(3.52)	(3.29)	(1.69)	(3.25)	(4.92)	(3.74)	(2.79)	(3.58)
Ice Cream		1.55	1.97*	.35	.18	1.33	2.64*	2.27*	1.29	1.92	-.39	1.76*	-.23
		(1.37)	(1.56)	(1.67)	(1.83)	(1.34)	(1.44)	(.67)	(1.26)	(1.75)	(1.60)	(1.35)	(1.30)
Ice Milk		2.21	.08	2.81	-1.08	2.81*	7.80*	.82	-2.97*	-1.18	-1.23	-.71	3.40*
		(2.03)	(2.31)	(2.43)	(2.74)	(2.10)	(2.19)	(1.03)	(1.85)	(2.68)	(2.31)	(1.92)	(2.03)
Nonfat Dry Milk		5.29*	1.45	-5.17*	8.24*	3.92*	-2.94	1.42	-1.03	-7.76*	-8.21*	-1.27	5.54*
		(3.16)	(3.39)	(3.78)	(4.12)	(3.00)	(2.94)	(1.59)	(3.05)	(5.31)	(5.10)	(2.96)	(3.10)
Cottage Cheese		3.18*	.21	.96	-3.48	-1.77	-1.86	.97	.27	-1.59	-5.37*	1.87	2.90*
		(2.04)	(2.29)	(2.84)	(3.13)	(2.22)	(2.49)	(1.27)	(2.24)	(2.91)	(3.45)	(2.15)	(1.90)
Process Cheese		.51	-.33	.36	.12	1.02	-.19	.83*	.58	3.04*	-1.73*	-.17	.20
		(.83)	(.87)	(.99)	(1.10)	(.83)	(.73)	(.39)	(.79)	(1.00)	(1.12)	(.80)	(.77)
American Cheddar		2.66*	.99	2.47*	.74	.51	1.20	.12	-.01	-.96	-1.24	-.87	-.72
		(.90)	(1.05)	(1.13)	(1.17)	(.99)	(1.01	(.46)	(.86)	(1.20)	(1.16)	(.90)	(.84)
Canned Milk		9.05*	12.31*	4.16	.05	3.84	.04	9.70*	-1.24	2.08	10.78*	13.60*	-5.69
		(6.46)	(7.25)	(7.78)	(8.13)	(6.35)	(6.61)	(3.13)	(6.31)	(8.24)	(7.10)	(6.00)	(6.24)

[1]Product quantities are in the same units as are indicated in Tables 1 and 2.

[2]Number of members in each category specified as the independent variable.

[3]Introduced as a zero-one variable. White race was the excluded category.

[4]Introduced as a set of zero-one variables. High school educated household head was the excluded category.

NOTE: Coefficient Standard errors in parentheses. An asterisk (*) indicates that the coefficient was statistically significant at the ten percent probability level.

tion rates for all households in the sample had been considered, the influence of race would have been more apparent. As it was, household consumption rates for consuming black households were equal to or lower than those for white households for all but canned milk. The negative influence of race was especially apparent for the fluid milk products (except buttermilk), nonfat dry milk powder and cottage cheese.

The important influence of household composition is apparent. The influence of specific age/sex groups was largely product dependent but, in general, it was the adult male and female, the male 15-20 years old, and the child between 7 and 14 who exerted the strongest positive influences on total household consumption. The *ceteris paribus* addition of one male 15-20 years old to the household resulted in a 121.65 half gallon increase in the 21 month household consumption rate of total fluid milk (69.5 half gallons per year). The addition of one member in this age/sex group also tended to substantially increase consumption rate of ice milk and nonfat dry milk powder. Ice milk consumption, relatively high in the South, was also influenced by the presence of females between 15 and 19. The presence of adult females and children between the ages of 7-14 exerted a stong positive influence on canned milk consumption.

The effects of the educational level of the household head also provided certain insights which helped explain the observed consumption patterns. Relative to high school graduate households, college educated households had higher consumption rates for two percent milk, ice milk, nonfat dry milk powder and cottage cheese. They had statistically significant lower consumption rates for regular whole milk. Grammar school households consumed higher levels of two percent milk, buttermilk, canned milk and ice cream than did high school graduate households, *ceteris paribus*.

CONCLUSIONS

Results of this study indicate that household consumption rates as well as per capita rates for most dairy products in the South tend to be substantially lower than the national average. Exceptions are ice milk, buttermilk and canned milk. Further, findings suggest that the reasons for such differences may be related to (a) relatively high retail prices for dairy products in the South, (b) relatively low levels of annual household income and (c) existing differences in demographic characteristics of the Southern region population relative to the total U.S.

Average prices paid for dairy products in the South tend to be substantially higher than the national average. Excepting buttermilk, nonfat dry milk powder and canned milk, percent differences in quantity purchased relative to the U.S. total varied inversely with the percent difference in average price paid. In addition, Southern consumers appear more responsive to changes in retail prices than do U.S. consumers generally. This was true for both short and long-run estimates.

Annual household incomes for panel households in the Southern region averaged $1546.24 below the national average during the period studied. Estimated income elasticities were, almost without exception, positive and greater in magnitude than those estimated for all U.S. households. While it appears that, for the industry in general, effects of increased incomes cannot be relied upon for important increases in consumption of most dairy products, Southern consumers, as their incomes rise, may be expected to increase their dairy products consumption rates faster than the national average.

Results also appear to reconfirm the important effect of certain demographic characteristics on consumption of dairy products [6, 8]. The Southern region sample had a relatively high proportion of both black and grammar school educated households. The influence of both characteristics on dairy product consumption rates has generally been negative. Grammar school households in the South did, however, consume signficantly more two percent milk, buttermilk, ice cream and canned milk than did highschool educated households, *ceteris paribus*.

Given the rather dramatic regional differences which appear to exist in both consumption patterns and relative responsiveness to price changes, the industry may wish to seriously consider those changes in the national milk pricing system which would result in establishing retail prices more nearly in line with principles of geographic price discrimination. Southern retail prices tend to be higher than the national average. This is partly because the current federal order pricing scheme is based on a competitively determined manufacturing price of grade milk in the Minnesota-Wisconsin milkshed, plus transportation costs from Eau Claire, Wisconsin. Until this system is changed and retail prices in the South are brought more nearly in line with the national average, Southern household consumption rates for most dairy products will

probably remain somewhat below the national average.

There appears to be little difference between long-run estimates of price elasticity for fluid versus manufactured products. Given this finding, longer-run consequences of placing disproportionate increases on fluid milk prices to cover increased production and processing costs should be examined. A policy which spreads such costs over more dairy products may have more desirable consequences over the long-run.

Findings also have important implications for the dairy industry in the South. If sales are to be maintained at current levels, all segments of the industry should try to improve efficiency and keep retail prices as low as possible consistent, of course, with adequate returns to labor, captial and management. Long-run consequences of increasing prices, especially for fluid milk products, do not appear as painless as the generally accepted short-run elasticity estimates imply. State milk commissions and other pricing authorities must therefore carefully weigh both costs and benefits of further increases in relative dairy product prices.

Finally, since demographic characteristics of a population are not easily changed, additional research may be needed to help explain why consumption patterns vary by such factors as race, education level or occupational status. It may be that industry-wide promotional campaigns, designed to reach those households not presently consuming dairy products on a regular basis, would achieve more satisfactory results.

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