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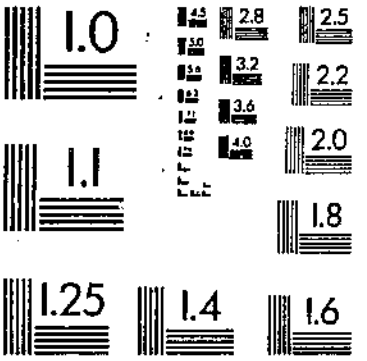

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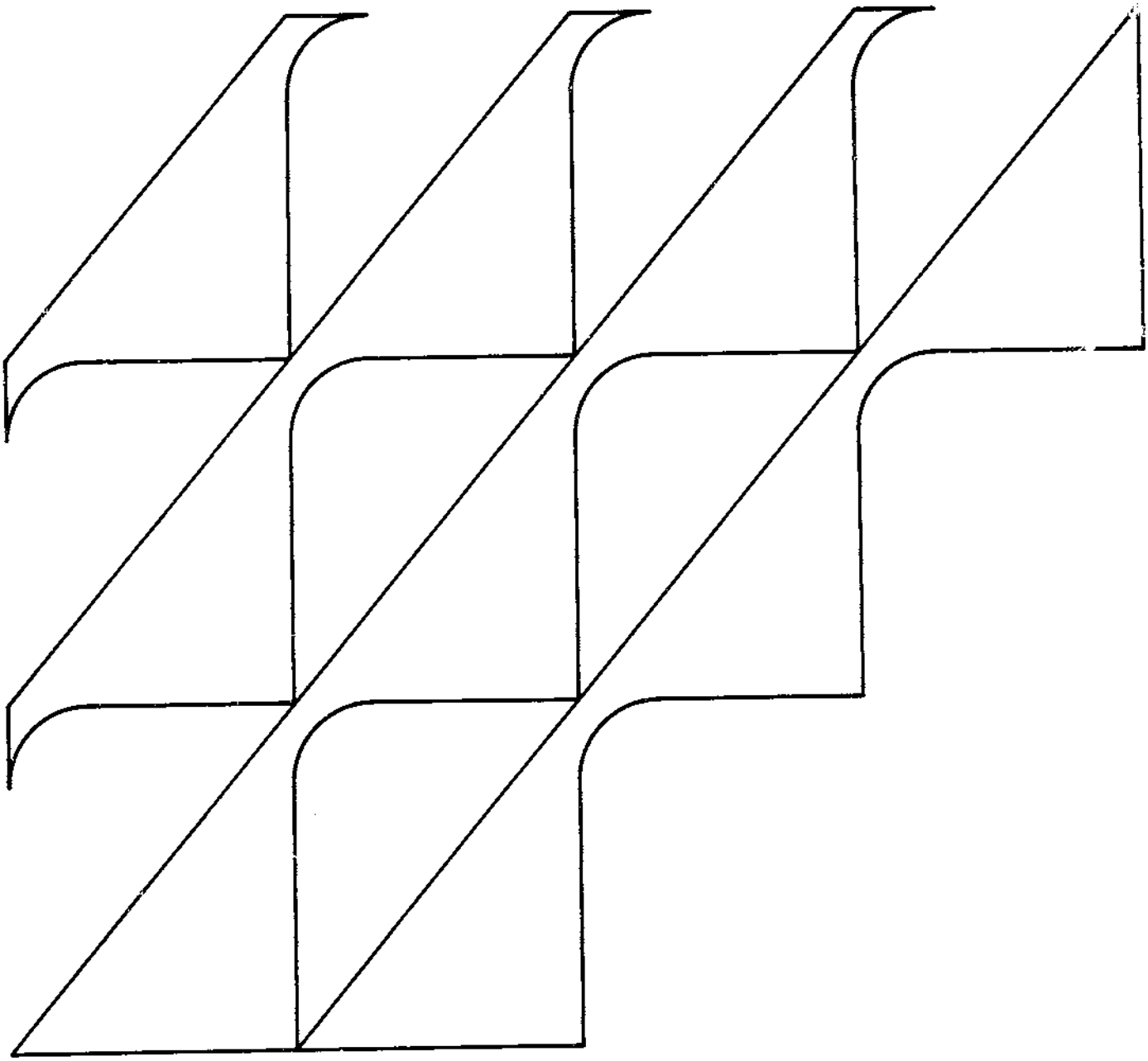
Economic Research Service

Technical Bulletin Number 1686

Effects of Household Socioeconomic Features on Dairy Purchases

James R. Blaylock
David M. Smallwood



EFFECTS OF HOUSEHOLD SOCIOECONOMIC FEATURES ON DAIRY PURCHASES. James R. Blaylock and David M. Smallwood. National Economics Division, Economic Research Service, U.S. Department of Agriculture. Technical Bulletin No. 1686.

Abstract

Higher income households likely spend less per person on whole and canned milk than do lower income households, but more on most other dairy products, according to this technical analysis of the effect of household socioeconomic features on dairy purchases. For example, a 10-percent increase in income generates a 1.3-percent decline in fresh whole milk expenditures, but a 3.5-percent increase in spending for cream. U.S. region, urbanization, season, and race, age composition, and food stamp status of households also affect spending for the 20 dairy products analyzed. Using the Tobit analytical method, the authors based the study on USDA's 1977-78 Nationwide Food Consumption Survey.

Keywords: Dairy expenditures, income, socioeconomic characteristics, households, Tobit analysis, 1977-78 Nationwide Food Consumption Survey.

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Summary

Household spending for whole and canned milk declines as income climbs. But, at-home expenditures per person for most other dairy products climb with added income.

The impact of income and other household characteristics on per person dairy expenditures is measured in this technical analysis of data from the U.S. Department of Agriculture's Nationwide Food Consumption Survey. The authors used Tobit statistical analysis to generate information on (1) changes in number of users of the product and (2) changes in expenditures by those already using the product. Results can be used to estimate effects of changing population characteristics on consumer dairy purchases, particularly important to government policymakers, processors, marketers, and farmers in planning production and marketing programs.

Specific findings of the simulation analysis are:

Income—A 10-percent increase in household income generates a 3.5-percent increase in per person spending for cream and more than 2-percent increases for cottage cheese, sour cream, dips, and butter. But, the same income increase results in a drop of over 1 percent in fresh whole milk and canned milk purchases.

Region—Per person expenditures for dairy products are highest in the Northeast and lowest in the South. Northeasterners spend more for cheese and butter, but less on margarine, than do residents of other U.S. regions.

Urbanization—Dairy expenditures by suburban residents more closely resemble those of central city residents than expenditures by residents of nonmetropolitan areas.

Race—Black and other nonwhite racial groups spend almost 25 percent less on dairy items than do whites.

Season—Dairy expenditures are higher in summer, fall, and winter than in spring. That frozen dessert spending is lowest in the fall and winter is no surprise.

Age—Households with children under 2 years spend more per person on dairy products than do similar households without young children. Elderly person households have higher per person expenditures for processed milk, cream, and margarine. The types of dairy products purchased depend importantly on the age composition of the household.

Food stamp status—Households receiving food stamps spend more per person on dairy products—but usually on less expensive items—than do similar households not receiving food stamps.

Effects of Household Socioeconomic Features on Dairy Purchases

James R. Blaylock
David M. Smallwood

Introduction

This report measures effects of socioeconomic characteristics and changing income on the retail demand for dairy products by households. The socioeconomic features of households investigated in this study were region of residence, urbanization, race, season, age composition, and food stamp participation. Results can be used to estimate changes in consumer demand due to changing demographic and economic characteristics, as well as to identify segments of the population for which expenditures for dairy products are high or low relative to the national average.

Dairy product groups found in this study to be most responsive to an increase in income were low fat milk, cream, cheese, cottage cheese, sour cream and dips, and butter. Statistically significant negative income responses were found for whole milk and canned milk. Many of the household socioeconomic characteristics analyzed had important effects on household expenditures for both aggregated and disaggregated dairy expenditures. For example, substantial regional, racial, and seasonal variation in per person expenditures were found. Ages of household members also have a major influence on the types and amounts of dairy products purchased by the household.

This report, analyzing expenditures for dairy products purchased for consumption in the home, is based on statistical analyses of household expenditure data reported in the U.S. Department of Agriculture's 1977-78 Nationwide Food Consumption Survey (NFCS). That survey is the latest source of data of this type. A statistical method known as the Tobit procedure is used. This procedure allows one to decompose an average household's demand response resulting from changes in income and other demand determinants into component parts that provide additional useful information: (1) changes in the number of actual users of the product in the total population, and (2) changes in expenditures by those already using the product. This decomposition of average household demand responses is important for developing a marketing strategy and analyzing the potential for market growth.

Theoretical Considerations

There are at least two aspects of household surveys of food consumption and/or expenditures deserving special consideration. First, one must distinguish whether the surveys measure use, intake, or expenditure. Household food consumption surveys generally measure the amounts, kinds, values, and sources of food used at home. Food items, whether purchased during the survey week or used from home inventories and without regard to their source (that is purchased, home grown, or other source) are included in the survey. Expenditure surveys, however, measure product purchases during the survey period and are not necessarily identical with product use because of changing food inventories and the use of nonpurchased food.

Surveys of household food use and/or expenditures are typically designed to obtain measures of at-home food use or expenditure for many detailed items. Thus, to limit respondent burden, the survey designer usually limits the time period for which the information is solicited to a 1- or 2-week period. Since the surveyed period is short, it is common for a given household not to report use or purchase of many detailed items. Whether the household ever uses the item(s) in question is usually unknown since entry or exit from product markets cannot be distinguished from frequency of product use. This study assumed that a household's use and frequency of use is related to household income and selected household characteristics.

Classicial demand theory does not explicity account for the entry and exit of consumers from given product markets (or the frequency in which a commodity is used) because the preference field is assumed to be limited to the strictly positive orthant of the commodity space. Hence, the quantity demanded of all goods

which enter the utility function is restricted to be strictly positive. However, Samuelson (*5*), among others, has indicated that entry-exit behavior can be recognized via so-called "corner solutions" in the utility maximization process (italicized numbers in parentheses identify items in References section). Many alternative scenarios can be developed which would lead to zero expenditures on a product (that is, a "corner solution"). However, the central point is that for many of these situations, changes in income or relative prices, for example, can cause expenditures to change from a corner solution to some positive level.

Changes in income or other variables cause changes in the number of consuming units as well as changes in the expenditures of those already consuming the item. The entry and exit of consumers from the market for particular goods in response to demand factors and, likewise, the frequency of product use, may be just as important, if not more so, than the changes in the average expenditure level by participants already in the market. Importance of the frequency of use component of demand responses increases as the item in question becomes more narrowly defined. This is because the proportion of consumers purchasing a more narrowly defined item is lower and, consequently, the potential for growth is greater. Also, closely related substitute products become more numerous as product categories are narrowed which increases the likelihood of product switching.

The derivation of the frequency of use component (entry and exit) of market demand will be developed along the lines of Haidacher (*2*). The jth individual's expenditure function for a given good, assuming constant prices, can be written as:

$$te_j = f_j(S_j, m_j) \tag{1}$$

where te is expenditure, S represents a set of socioeconomic characteristics, and m denotes income. Total expenditures in a market consisting of N consumers are:

$$TE = \sum_{j=1}^{N} te_j = F(S_1, \ldots, S_N, m_1, \ldots, m_N) \tag{2}$$

and the aggregate income elasticity is:

$$E_{TE} = \sum_{j=1}^{N} (te_j/TE)e_j \tag{3}$$

where

$e_j = \frac{\partial te_j}{\partial m_j} \cdot \frac{m_j}{te_j}$ is the jth individual's income elasticity for a particular good.

Given the relationship in (2), assume there exists a minimum level of income $m^{min} > 0$ such that for $m < m^{min}$ there are r consumers for which $te_j > 0$ and $N - r$ for which $te_j = 0$; and consequently, that

$$r = r(m) \text{ and } \frac{\partial r}{\partial m} > 0. \tag{4}$$

Define $P = r/N$ as the proportion of purchasing consumers and

$$A = (1/r) \sum_{j=1}^{N} te_j \tag{5}$$

as the average expenditures of the r purchasing consumers. Therefore, TE = APN and equation (3) can be rewritten as:

$$E_{TE} = \frac{\partial(APN)}{\partial m} \cdot \frac{m}{APN} = \frac{\partial A}{\partial m} \cdot \frac{m}{A} + \frac{\partial P}{\partial m} \cdot \frac{m}{P}$$
$$= E_A + E_m. \tag{6}$$

E_m is termed the frequency of use or entry-exit elasticity and E_A the average purchase elasticity. E_m captures the effect on the aggregate income elasticity of those consumers who enter (or exit) the market or use a product more (or less) frequently in the sense that their purchases vary from zero to some positive quantity for a given increase (decrease) in income. On the other hand, E_A captures the effect of the income response of those consumers who adjust their purchases to income changes by a movement along their respective demand curves. Alternatively, E_A can be viewed as the aggregate income elasticity, E_{TE}, "adjusted" for the effect of changes in the number of consumers using the good.

Measurement Procedures

This section briefly describes the procedures used to measure both the aggregate income elasticity and its two component elasticities. A single cross-sectional survey typically contains a large number of households in the sample which reported not using a given product during the survey period. If one analyzes the behavior of only those households purchasing a product, and the use or nonuse of the product is determined by the same set of factors that determine the level of use, then traditional regression methods result in biased parameter estimates, and perhaps more importantly, valuable information may be ignored. A useful statistical technique proposed for analyzing the frequency of use decision simultaneously with the level of purchases is the Tobit procedure (*7, 3*).

The model underlying the Tobit method may be mathematically expressed as:

$$y_t = X_t\beta + \epsilon_t \quad \text{if } X_t\beta + \epsilon_t > 0$$
$$= 0 \quad \text{if } X_t\beta + \epsilon_t \leq 0 \tag{7}$$

where $t = 1,2,\ldots,T$, T is the number observations, y_t is expenditure on a given item, X represents a vector of independent variables, β is a vector of unknown coefficients, and ϵ_t is an independently distributed error term

assumed to be normal with mean zero and constant variance σ^2. Thus, the model assumes that expenditure is related to an underlying stochastic index, $X_i\beta + \epsilon_i$, which is composed of observable household demand factors and a random component composed of unobserved factors which vary from household to household. Furthermore, when the index is positive, it is equal to observed expenditure; when it is nonpositive, it is not directly observable but expenditure is observed and equal to zero.

The expected value of y_i in the model is equal to:

$$E(y_i) = X_i\beta F(z_i) + \sigma f(z_i), \tag{8}$$

where $z_i = X_i\beta/\sigma$, $f(z_i)$ is the unit normal density, and $F(z_i)$ is the cumulative normal distribution function. The expected value of y for observations above the limit (that is, positive expenditures), y^*, is $X\beta$ plus the expected value of the truncated normal error term (ϵ):

$$\begin{aligned} E(y^*) &= E(y \mid y > 0) \\ &= E(y \mid \epsilon > -X\beta) \\ &= X\beta + \sigma f(z)/F(z). \end{aligned} \tag{9}$$

The relationship between the expected value of y over all observations, E(y), the expected value conditional upon being above the limit, $E(y^*)$, and the probability of being above the limit, F(z), is:

$$E(y) = F(z)\, E(y^*). \tag{10}$$

The effect of a change in the *ith* independent variable on the expected value of y can be expressed as:

$$\partial E(y)/\partial X_i = F(z)(\partial E(y^*)/\partial X_i) + E(y^*)(\partial F(z)/\partial X_i). \tag{11}$$

Thus, the total change in y can be disaggregated into two parts: (1) the change in y of those above the limit, weighted by the probability of being above the limit and (2) the change in the probability of being above the limit, weighted by the expected value of y if above the limit.

Given estimates of β and σ, each of the terms in equation (11) can be evaluated at some value of the X's, usually at the means. The value of $E(y^*)$ can be calculated from equation (9), and recall that f(z) and F(z) are the standard normal density and probability functions, respectively. The two partial derivatives in equation (11) can be calculated as:

$$\partial F(z)/\partial X_i = f(z)(\partial X\beta/\partial X_i)/\sigma \tag{12}$$

and, from equation (9),

$$\begin{aligned} \partial E(y^*)/\partial X_i &= \partial X\beta/\partial X_i + (\sigma/F(z))\partial f(z)/\partial X_i \\ &\quad - (\sigma f(z)/F(z)^2)\partial F(z)/\partial X_i \\ &= \partial X\beta/\partial X_i[1 - zf(z)/F(z) - f(z)^2/F(z)^2], \end{aligned} \tag{13}$$

using $\partial F(z)/\partial z = f(z)$ and $\partial f(z)/\partial z = -zf(z)$ for a unit normal density.

The total effect $\partial E(y)/\partial X_i$ can be shown to equal $F(z)\partial X\beta/\partial X_i$ by substituting equations (12) and (13) into equation (11). Also, by dividing both sides of equation (13) by $F(z)\partial X\beta/\partial X_i$, you can show that the fraction of the total effect $\partial E(y)/\partial X_i$ due to the eifect above the limit, $\partial E(y^*)/\partial X_i$, is:

$$[1 - zf(z)/F(z) - f(z)^2/F(z)^2]. \tag{14}$$

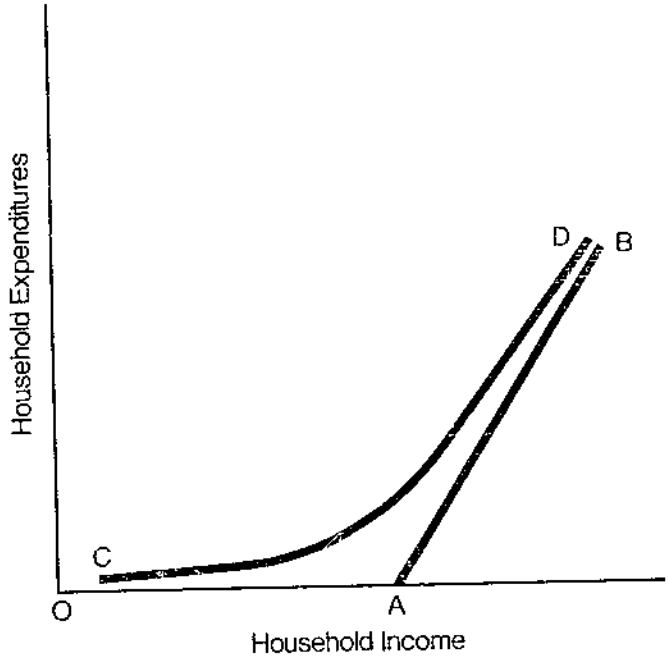
A graphical analysis as presented in figure 1 may help clarify the situation. Assume that expenditures are a function of income only. For example, with many dairy items, there will be a concentration of zero purchases at low-income levels. At some level of income, expenditure on a particular item becomes feasible. In figure 1, for example, at incomes greater than A, households would report positive purchases and at incomes less than A, zero purchases.

At incomes below A, there would be a series of observations for which expenditures are zero. If all households were identical, except for income level, the Engel curve would be a broken line like OAB in figure 1. But if the critical income level OA were not the same for all households, the average Engel curve for groups of households would be similar to the curve CD. Therefore, the demand curve to be estimated in this situation is similar to the curve CD, rather than the traditionally estimated line AB.

Average expenditures for the total population are a combination of both average household expenditures of those households purchasing and participation rates.

Figure 1.

Engle curves



Therefore, elasticities derived from cross-sectional data comprised of both purchasing and nonpurchasing households are a combination of the two responses to income: (1) the response of expenditures by households actually using the good and (2) the response due to changes in the frequency of use stated in terms of the proportion of households using the product.

Use of the Tobit method allows one to derive the probability that a household will purchase some particular dairy product and the expected amount of expenditures. The Tobit method also allows use of information supplied by nonconsuming households as well as those consuming.

Data

The 1977-78 NFCS is the most recent of six national household food consumption surveys conducted by the USDA. The others were conducted in 1935-36, 1942, 1948, 1955, and 1965-66. The survey sample is representative of households in the 48 conterminous States and contains information on household socioeconomic characteristics and the types and amounts of foods used. The survey has two parts: (1) a 1-week recall of the kinds, quantities, values, and sources of food used from home supplies, and (2) an individual intake record for each household member listing the kinds and quantities of food consumed, both at home and away from home.[1] The household portion of the survey provides the basis for the analysis presented here. Thus, the quantities and values reported relate to foods used from home supplies during a 7-day period.

The cross-sectional data for the survey were collected over a 1-year period beginning in spring (April 1977) and ending the following winter (March 1978). Thus, four quarters of data are available for analysis from the 1977-78 NFCS.[2] The large sample size and great diversity of household characteristics contained in this survey permit measurement of the relationship between these characteristics and at-home dairy expenditures.

Information on household characteristics and food use was obtained in the survey through personal interviews with the household member most responsible for food purchases and preparation. The households were contacted at least 1 week prior to the interview and asked to keep unstructured notes on food use and expenditures to assist them during the interview. In addition, trained interviewers used a detailed food item list to assist the respondents in recalling information on the kinds, quantities, values, and sources of food used from home supplies during the 7 days immediately preceding the interview. Foods were measured in the form in which they entered the household. Households reporting the use of nonpurchased dairy foods such as those produced at home or received through donations, programs for the elderly, gifts or pay were excluded from this analysis. Demand responses for these households are likely to be different from those participating only in the retail market. Foods consumed away from home such as at restaurants, schools, and cafeterias were also excluded.

In the 1977-78 NFCS, dairy consumption is measured both in terms of quantity (physical weight) and money value (expenditure). The expenditure on a good is equal to the price-weighted sum of the quantities used (value) and hence, if prices are relatively constant across households, then expenditures may be interpreted as a value-weighted quantity index. The expenditure measure is more relevant than product weight as a measure of consumer satisfaction or well-being in the sense that the prices consumers are willing to pay reflect the unit value of the goods. For example, with the expenditure measure of consumption, one would assume that a consumer who purchases a gallon of milk for $1 and a gallon of ice cream for $2 would obtain twice the satisfaction from the gallon of ice cream compared to the gallon of milk.[3] Throughout this study, we use the term expenditure to mean the money value of purchased dairy products used during the survey period.

The large number of detailed dairy and dairy-related items recorded in the survey necessitates grouping the items into a manageable number of categories for analysis. The individual items were grouped into 20 categories according to similarity of use or product characteristic. Presented in table 1 are the 20 product groups and the items making up each. There are two broad groups: (1) dairy and related products and (2) dairy products. The only difference between the categories is that the former includes cream substitutes and margarine while the latter excludes these items.

Mean after-tax household income and household size by various socioeconomic characteristics are presented

[1]Home supplies include food and beverages used at home during the 7 days before the date of the survey interview, whether bought or received without direct expenditure. Included were food and beverages (1) eaten at home, (2) carried from home in packaged meals, (3) thrown away, and (4) fed to pets. Excluded from food at home were (1) commercial pet food and household food fed to animals raised for commercial purposes, (2) food that was given away for use outside the home, and (3) food consumed at restaurants, fast-food outlets, roadside stands, and meals at friends' or relatives' homes. Dairy items purchased at restaurants and other places, and brought home for consumption are included in the analysis. However, dairy products purchased as ingredients in other foods such as cheese in a pizza are classified as mixtures in the survey data and are excluded from this analysis.

[2]The sample was chosen using a multistage, stratified probability sampling procedure. Sampling weights are used in the tabular analysis to improve the representation of the sample (Appendix). For a more complete description of the 1977-78 NFCS sample, see Rizek (*4*).

[3]Another reason for concentrating on expenditures is the difficulty in aggregating the numerous dairy products into a manageable number of groups when the items are measured in physical units.

in table 2. A great diversity in after-tax income and household size are found across the selected socioeconomic characteristics. This analysis of the 1977-78 NFCS data reveals that households in the West are smaller and have higher incomes than do their counterparts in other regions. Southern households have the lowest incomes while North Central households are the largest in terms of size. White households have considerably larger incomes than nonwhites and also have fewer household members. The mean after-tax income for the poorest 20 percent of the survey households was $3,385 in contrast to $23,168 for the richest 20 percent. However, the income disparity is narrowed if one adjusts for household size because lower income households tend to have fewer household members.

Suburban households have larger incomes than do either central city or nonmetropolitan residents; but, the suburbanites also have the largest household size.

Table 3 contains the proportion of sample households purchasing dairy products during the survey week. For example, over 99 percent of the surveyed households used dairy and related products during their survey week.

Appendix tables 1-7 contain average per capita at-home dairy expenditures tabulated by six socioeconomic characteristics. These tables are for descriptive purposes only as they do not isolate the effect of a single socioeconomic characteristic on dairy expenditures. That is, other socioeconomic factors are not held constant in these tables. For example, household size, income, and other factors are not necessarily constant in the tabulation by racial group.

The dependent variables used in the Tobit models are weekly per person expenditures on the particular product group under consideration. The independent

Table 1—Product groups and their composition

Product group	Group composition
Dairy and related products	Includes all dairy-based items, cream substitutes, and margarine
Dairy products	All dairy-based items excluding cream substitutes and margarine
Fresh milk	Includes whole and other milk
Whole milk	Cow's, filled, and chocolate milk
Other milk	Butter, skim, lowfat, and 2% fat milk
Processed milk	Canned and dry milk
Canned milk	Evaporated, condensed, soy milk, infant formula, canned diet beverages, chocolate milk drink, and canned milkshakes
Dry milk	Nonfat, whole, butter, and soy dry milks, eggnog beads, protein-casein powder, dry infant formula, cocoa with nonfat dry milk, tiger milk, and dry diet beverages
Cream	Light, heavy, half and half, and eggnog
Cream substitutes	Fluid, whipped, powdered, and frozen cream substitutes
Frozen desserts	Ice cream, ice milk, sherbet, and miscellaneous desserts with milk or yogurt
Cheese	All types
Natural American and cheddar	Natural American and cheddar types excluding processed
Processed	Processed American and cheddar cheese and cheese spreads
Other cheese	Includes dry, imitation, swiss, cream cheese, and other cheese not of the natural American or cheddar types
Cottage cheese	Includes cottage cheese and yogurt
Sour cream and dips	Sour cream, sour cream substitutes, and all dairy-based dips
Table fats	Includes all types of butter and margarine
Butter	All types including sweet, whipped, honey, and danish
Margarine	Includes stick, sweet, soft-tub, imitation, reduced fat, whipped, liquid, flavored spreads, and half-butter and half-margarine

variables included are dummy variables for region and urbanization of household location, dummy variables for race of household head, log income, dummy variables for the season in which the household was surveyed, inverse of household size, number of guest meals (per household member) served, proportion of household members of ages 0-2, 3-12, 13-19, 20-39, 65 and over, and a dummy variable representing whether or not the household participates in the food stamp program. Detailed definitions of these variables are provided in table 4.

Empirical Results

Estimated parameters for the 20 dairy expenditure Tobit equations are presented in appendix table 8. Also included are several summary statistics useful for general information and model evaluation. The estimated equations generally provided a reasonably good fit to the data with most of the individual coefficients being statistically significant.

Influence of Income on Dairy Expenditures

Dairy product groups found to be most responsive to income changes were other milk, cream, other cheese, cottage cheese, sour cream and dips, and butter (table 5). A 10-percent increase in income was found to increase expenditures by more than 2 percent in each of these cases. But, a 10-percent increase in income was associated with declines in whole milk expenditures of about 1.3 percent and canned milk expenditures of about 1.2 percent. Of particular interest was the estimated negative effect of income on whole fresh milk and the positive effect on other fresh milk. This result may indicate that higher income households are more health conscious and, hence, substitute lower butter fat milk for whole milk.

Coefficients on log income were statistically significant at the 10-percent probability level for all but four product groups: fresh milk, processed milk, dry milk, and margarine. The latter four groups, however, were found

Table 2—Mean after-tax income and household size by various categories

Category	Income after taxes	Household size (members)
	Dollars	*Number*
Survey average	11,478	2.95
Region:		
Northeast	12,091	2.99
North Central	12,045	3.04
South	9,924	2.92
West	12,340	2.84
Race:		
White	12,135	2.89
Black	7,557	3.20
Nonwhite—nonblack	9,587	3.77
Income quintile:		
I — lowest	3,385	2.01
II	7,020	2.68
III	10,469	3.13
IV	14,567	3.41
V — highest	23,168	3.54
Household size (members):		
1	6,355	1.00
2	11,250	2.00
3	12,573	3.00
4	14,231	4.00
5	14,791	5.00
6 or more	14,664	6.78
Urbanization:		
Central city	10,127	2.75
Suburban	13,398	3.12
Nonmetropolitan	10,676	2.97

Source: Based on data from the 1977-78 NFCS.

Table 3—Proportion of sample households purchasing dairy products in a given week

Item	Percentage of sample purchasing item
	Percent
Dairy and related products[1]	99.4
Dairy products[2]	99.0
Fresh milk	93.0
Whole	69.6
Other	36.1
Processed milk	27.3
Canned	14.9
Dry	15.2
Cream	10.9
Cream substitutes	10.6
Frozen desserts	49.0
Cheese	77.0
Natural American and cheddar	34.5
Processed	43.4
Other	28.5
Cottage cheese	33.3
Sour cream and dips	11.1
Table fat	91.9
Butter	26.6
Margarine	78.7

[1]Margarine and cream substitutes are included in the dairy and related products category.
[2]Excludes margarine and cream substitutes.

Source: Based on data from the 1977-78 NFCS.

to have measured income responses which are small relative to those dairy product groups with statistically significant responses. For 14 product groups, the response to income was found to be positive and significant.

Total expenditure response to income changes was divided into household response due to frequency of use and response due to changing expenditure levels by those households already in the market. Frequency of use and/or entry or exit from the market accounted for over 50 percent of the total response for 15 out of the 20 product groups.

The frequency of use (entry or exit) phenomena accounted for over 80 percent of the total expenditure response for canned milk, dry milk, cream, cream substitutes, and sour cream and dips. This indicates that for many dairy items, marketing strategies should be geared towards households not purchasing (or purchas-

Table 4—Definitions of independent variables

Variable	Definition
Region:	
Northeast	Omitted base region
North Central	Equals 1 if household resides in North Central region, zero otherwise
South	Equals 1 if household resides in Southern region, zero otherwise
West	Equals 1 if household resides in Western region, zero otherwise
Urbanization:	
Central city	Omitted base group
Suburban	Equals 1 if household resides in suburban location, zero otherwise
Nonmetropolitan	Equals 1 if household resides in nonmetropolitan location, zero otherwise
Race:	
White	Omitted base group
Black	Equals 1 if household head is black, zero otherwise
Nonwhite-nonblack	Equals 1 if household head is nonwhite-nonblack, zero otherwise
Log income	Log of weekly per person after-tax household income including bonus value of food stamp transfers
Season:	
Spring	Omitted base season
Summer	Equal 1 if household was surveyed in the summer quarter, zero otherwise
Fall	Equals 1 if household was surveyed in the fall quarter, zero otherwise
Winter	Equals 1 if household was surveyed in the winter quarter, zero otherwise
Household size	Inverse of household size.
Guest meals	Number of per person guest meals served by a household during the survey week.
Household age composition:	
Percentage age 0-2 years	Proportion of household size composed of members 0-2 years old.
Percentage age 3-12 years	Proportion of household size composed of members 3-12 years old.
Percentage age 13-19 years	Proportion of household size composed of members 13-19 years old.
Percentage age 20-39 years	Proportion of household size composed of members 20-39 years old.
Percentage age 40-64 years	Omitted base group.
Percentage age 65 and over	Proportion of household size composed of members 65 years or older.
Food stamp program participation	Equals 1 if household participates in the food stamp program, zero otherwise.

ing infrequently) a particular item rather than households regularly purchasing the item. Conversely, frequency of use (entry or exit) accounted for only 20 percent of total response for total dairy products and the dairy and related products group.

The simulated expenditures displayed in table 6 were derived from the individual Tobit equations by holding all factors constant at their sample means and varying income. Except for those product groups which have a negative expenditure elasticity (that is, fresh milk, whole milk, processed milk, canned milk, and margarine), expenditures increase monotonically as income increases. For example, fresh whole milk expenditures decline about 20 percent when a household's income increases from $2,000 per person to $10,000 per person. Expenditures on sour cream and dips increase about 105 percent between the $2,000 and $10,000 levels. Recall that these response values include an expenditure level response and an entry-exit response. Results for other products are interpreted in an analogous manner.

Influence of Household Characteristics on Dairy Expenditures

Factors other than income which are hypothesized to effect a particular household's dairy expenditures include region and urban location of household residence, race, season, household age composition, and whether or not the household participates in the food stamp program. The influence of these factors, except the age composition of the household, were evaluated using dummy variables for selected categories of each factor (see table 2). For example, households were grouped into four categories according to the region of household residence: Northeast, North Central, South, and West. The influence of household age composition

Table 5—Dairy expenditure response to a 10-percent increase in income[1]

Item	Expenditure response			
	Total response	Market entry response	Expenditure level response	Percentage of response due to market entry
		Percent		
Dairy and related products[2]	0.72*	0.14	0.59	19
Dairy products[3]	.77*	.16	.57	21
Fresh milk				
Whole	−.09	−.03	−.06	34
Other	−1.34*	−.71	−.63	53
Processed milk	2.64*	1.85	.79	70
Canned	−.16	−.12	−.04	76
Dry	−1.18*	−.98	−.21	82
Cream	.75	.61	.14	81
Cream substitutes	3.50*	2.91	.60	83
Frozen desserts	1.89*	1.57	.32	83
Cheese	1.68*	1.09	.59	65
Natural American and cheddar	1.71*	.84	.87	49
Processed	1.05*	.75	.30	71
Other	1.26*	.72	.54	68
Cottage cheese	4.25*	3.23	1.02	76
Sour cream and dips	2.40*	1.75	.65	73
Table fat	4.51*	3.97	.54	88
Butter	.44*	.17	.27	38
Margarine	2.41*	1.83	.58	76
	−.22	−.10	−.12	46

Note: *denotes significant at the 0.10 level. Statistical tests of significance are not performed for the individual components of income response.

[1]Factors other than income are held constant at their sample means.
[2]Includes margarine and cream substitutes.
[3]Excludes margarine and cream substitutes.

was evaluated by including the proportion of a household's size in each of five age groups. The estimated effect of each factor is discussed below.

Region: Expenditures on dairy items generally exhibit substantial regional variation. The Northeast region is the base group in table 7 with dairy expenditures for the other regions given as a percentage change from this base. Per person expenditures on all dairy products combined are highest in the Northeast and lowest in the South. This expenditure pattern is also true for cheese, but does not hold for all categories. For example, other fresh milk expenditures are higher in the North Central, South, and West than in the Northeast. Natural American and cheddar cheese expenditures are higher in regions other than the Northeast but northeasterners appear to spend more for processed and other cheeses. Northeastern residents also spend more for butter and less on margarine than do residents of other regions. There appears to be slightly more homogeneity with respect to dairy expenditures in the North Central, South, and West regions than across the entire country. Some of the apparent differences in regional expenditure patterns may be caused by relative price differences or historic dairy product standards. For example, during the survey period, cottage cheese was priced higher in the South relative to the prices in the other regions. This may partially account for the lower expenditures on cottage cheese by southerners compared to the other regions.

Urbanization: There is little variation in aggregate expenditures for dairy products by urbanization (table 8). However, there is substantial variation for individual product groups. The consumption patterns for suburban residents are generally more closely related to those of central city residents than to those of nonmetropolitan residents. The only statistically significant differences in dairy item expenditures between central city and suburban residents were for other milk, cream substitutes, frozen desserts, and natural American and cheddar cheeses. Nonmetropolitan residents, however, have simulated expenditures which are statistically different from central city residents in 12 of the 20 dairy

Table 6—Simulated weekly per person dairy expenditures at different per capita income levels[1]

Item	Income level				
	$2,000 (base)	Percentage change from base			
		$4,000	$6,000	$8,000	$10,000
	Dollars	*Percent*			
Dairy and related products[2]	2.112	5.2	8.3	10.5	12.2
Dairy products[3]	1.952	5.6	8.9	11.2	13.0
Fresh milk	.951	−.6	−1.0	−1.3	−1.5
Whole	.684	−8.7	−13.6	−17.0	−19.6
Other	.230	20.6	33.9	43.9	52.1
Processed milk	.137	−1.1	−1.7	−2.1	−2.5
Canned	.065	−7.8	−12.1	−15.1	−17.3
Dry	.061	5.3	8.6	10.9	12.7
Cream	.023	27.9	47.1	62.1	74.5
Cream substitutes	.015	14.1	23.2	29.9	35.3
Frozen desserts	.205	12.6	20.4	26.1	30.7
Cheese	.457	12.9	20.9	26.6	31.2
Natural American and cheddar	.166	7.6	12.2	15.6	18.3
Processed	.155	9.3	14.9	19.1	22.4
Other	.099	35.4	60.2	79.6	95.9
Cottage cheese	.131	18.4	30.3	39.2	46.5
Sour cream and dips	.016	37.7	64.7	86.4	104.8
Table fat	.233	3.1	5.0	6.3	7.3
Butter	.062	18.5	30.5	39.5	46.8
Margarine	.154	−1.5	−2.4	−3.0	−3.5

[1]Factors other than income are held constant at their sample means.
[2]Includes margarine and cream substitutes.
[3]Excludes margarine and cream substitutes.

categories. Particularly large differences were found for canned milk, other cheeses, sour cream and dips, and butter.

Race: Both the black and nonwhite-nonblack racial groups have lower simulated weekly per person expenditures than do whites for virtually all dairy items where a statistically significant difference was found (table 9). For example, blacks spend almost 25 percent less per person than do whites for total dairy products, 25 percent less for cheese, and 20 percent less for margarine. However, blacks spend approximately 86 percent more for canned milk. These findings are consistent with those reported by Thraen, Hammond, and Buxton (6).

Season: Weekly per person dairy expenditures vary significantly by season (table 10). Expenditures are higher in the summer, fall, and winter than in the spring for total dairy expenditures as well as for many of the dairy product groups. For example, processed milk expenditures are highest in the fall and winter. This may be due to holiday food preparation and baking. Per person frozen dessert expenditures are lowest in the fall and winter seasons.

Age Composition: Households with children age 2 and under tend to spend more per person on total dairy products than do similar households without young children (table 11). This is caused almost exclusively by higher expenditures for fresh and processed milk (which includes infant formula). However, households with infants spend considerably less per person for frozen desserts, cheese, and table fats. Households with teenagers also spend more per person on total dairy products than do similar households without teens. This household type spends considerably more for fresh milk, frozen desserts, processed cheese, and sour cream and dips. Households composed of elderly persons spend considerably more per person on other milk, processed milk, cream, and margarine than do similar household without elderly members. The elderly, however, appear to spend less on cheese, especially

Table 7—Simulated weekly per person dairy expenditures by region[1]

Item	Region			
	Northeast (base)	Percentage change from base		
		North Central	South	West
	Dollars	*Percent*		
Dairy and related products[2]	2.412	−11.2*	−14.0*	−4.5*
Dairy products[3]	2.263	−13.1*	−15.4*	−5.1*
Fresh milk	.966	−.5.7*	.6	−.42*
Whole	.783	−37.6*	−6.1*	−32.9*
Other	.164	128.7*	40.1*	117.0*
Processed milk	.123	−11.0*	16.9*	34.5*
Canned	.039	9.3	121.5*	91.8*
Dry	.074	−20.6*	−33.4*	16.0*
Cream	.032	20.5*	−48.8*	14.2
Cream substitutes	.018	14.8*	−24.4*	−17.0
Frozen desserts	.260	−11.8*	−16.4*	−15.7*
Cheese	.581	−15.1*	−24.3*	−1.5
Natural American and cheddar	.132	26.0*	24.4*	98.4*
Processed	.196	−8.8*	−10.7*	−34.5*
Other	.247	−45.5*	−73.0*	−34.1*
Cottage cheese	.190	−4.9	−52.5*	6.7
Sour cream and dips	.025	−3.0	−43.8*	7.4
Table fat	.278	−10.9*	−22.7*	−16.6*
Butter	.144	−49.6*	−69.8*	−50.9*
Margarine	.134	22.5*	16.5*	13.6*

Note: *denotes significant difference at the 0.10 level.

[1]Factors other than region are held constant at their sample means.
[2]Includes margarine and cream substitutes.
[3]Excludes margarine and cream substitutes.

processed. These results confirm that considerable differences exist in expenditure on dairy products among households composed of different age groups. These results are useful for not only marketing analysis but also for examining changes in expenditures due to the changing age distribution of the population.

Food Stamp Participation: Households receiving food stamps spend more per person on total dairy products than do similar households not receiving food stamps. Results cited in table 12 imply that households receiving food stamps generally use less expensive types of dairy products than do their nonfood stamp counterparts.

Table 8—Simulated weekly per person dairy expenditures by urbanization[1]

Item	Urbanization		
	Central city (base)	Percentage change from base	
		Suburban	Nonmetropolitan
	Dollars	*Percent*	
Dairy and related products[2]	2.211	2.1	−2.2
Dairy products[3]	2.058	2.2	−3.3*
Fresh milk	.932	1.0	3.2
Whole	.633	−2.8	1.5
Other	.246	17.8*	11.1*
Processed milk	.132	−7.2	17.4*
Canned	.058	−13.3	29.4*
Dry	.061	−2.2	16.4*
Cream	.026	10.7	8.1
Cream substitutes	.015	17.6*	14.6
Frozen desserts	.215	12.0*	5.4
Cheese	.526	3.5	−12.5*
Natural American and cheddar	.166	8.9*	10.1*
Processed	.174	1.3	−12.2*
Other	.148	5.2	−36.0*
Cottage cheese	.154	1.7	−5.1
Sour cream and dips	.023	10.7	−25.8*
Table fat	.241	.3	−2.1
Butter	.082	.2	−34.1*
Margarine	.146	−.3	13.6*

Note: *denotes significant difference at the 0.10 level.

[1]Factors other than urbanization are held constant at their sample means.
[2]Includes margarine and cream substitutes.
[3]Excludes margarine and cream substitutes.

Table 9—Simulated weekly per person dairy expenditures by race[1]

Item	Race		
	White (base)	Percentage change from base	
		Black	Nonwhite-nonblack
	Dollars	*Percent*	
Dairy and related products[2]	2.275	−24.8*	−6.8*
Dairy products[3]	2.110	−24.8*	−6.4*
Fresh milk	.975	−28.7*	.7
Whole	.632	−12.4*	39.1*
Other	.300	−48.5*	−79.7*
Processed milk	.136	8.4	−39.1*
Canned	.056	86.5*	3.7
Dry	.071	−56.0*	−72.0*
Cream	.030	−35.4*	−57.9*
Cream substitutes	.019	−64.3*	−57.9*
Frozen desserts	.233	−12.7*	−22.3*
Cheese	.526	−25.0*	−9.0
Natural American and cheddar	.181	−11.2*	−20.5*
Processed	.173	−27.1*	−6.6
Other	.144	−63.0*	−20.9*
Cottage cheese	.170	−67.8*	−20.1*
Sour cream and dips	.025	−78.8*	−45.5*
Table fat	.243	−11.5*	−11.1*
Butter	.071	12.1	−16.3
Margarine	.156	−20.2*	−10.2*

Note: *denotes significant difference at the 0.10 level.

[1]Factors other than race are held constant at their sample means.
[2]Includes margarine and cream substitutes.
[3]Excludes margarine and cream substitutes.

Table 10—Simulated weekly per person dairy expenditures by season[1]

Item	Spring (base)	Season		
		Percentage change from base		
		Summer	Fall	Winter
	Dollars	*Percent*		
Dairy and related products[2]	2.100	7.2*	7.3*	− 6.5*
Dairy products[3]	1.956	6.7*	6.6*	5.8*
Fresh milk	.893	5.3*	8.2*	9.6*
Whole	.577	7.5*	13.9*	14.2*
Other	.275	.3	−3.0	−.8
Processed milk	.128	−8.3	17.7*	13.9*
Canned	.056	6.2	19.4*	1.3
Dry	.059	−20.5*	19.2*	35.2*
Cream	.028	−7.4	17.5	−2.0
Cream substitutes	.018	−26.7*	−8.4	2.0
Frozen desserts	.243	9.6*	−11.4*	−17.4*
Cheese	.482	5.4*	8.8*	8.4*
Natural American and cheddar	.169	3.1	8.5	8.5
Processed	.153	8.6*	9.4*	19.3*
Other	.130	−4.9	5.1	−1.3
Cottage cheese	.159	3.2	−9.8*	−7.1
Sour cream and dips	.020	1.9	4.6	9.4
Table fat	.212	12.9*	19.8*	17.1*
Butter	.066	3.6	15.4*	12.1*
Margarine	.135	14.7*	18.5*	16.6*

Note: *denotes significant difference at the 0.10 level.

[1]Factors other than season are held constant at their sample means.
[2]Includes margarine and cream substitutes.
[3]Excludes margarine and cream substitutes.

Table 11—Simulated weekly per person dairy expenditures by age group[1]

Item	Age (years)					
	40-64 (base)	Percentage change from base				
		0-2	3-12	13-19	20-39	65 and over
	Dollars	*Percent*				
Dairy and related products[2]	2.194	15.2*	−5.8	17.1*	−2.6	0.1
Dairy products[3]	2.006	19.2*	−3.6	20.6*	.4	−1.8
Fresh milk	.880	35.7*	20.5*	46.5*	−3.7	.3
Whole	.599	5.6	22.8*	45.6*	−4.9	−5.2
Other	.271	39.8*	−21.6*	10.4	−5.5	18.7*
Processed milk	.132	614.4*	−31.8*	11.5	−20.7*	19.6*
Canned	.064	1,522.2*	−49.0*	−6.3	−43.9*	37.2*
Dry	.061	45.2	−8.7	35.4	−2.1	11.3
Cream	.032	−37.1	−19.1	−22.2	−38.7*	62.3*
Cream substitutes	.021	−30.7	−20.6	−25.7	−57.2*	56.6*
Frozen desserts	.232	−36.4*	16.7	23.1*	−19.5*	14.6*
Cheese	.494	−28.9*	−8.5	11.2	22.9*	−14.1*
Natural American and cheddar	.179	−19.8	−18.5	19.7	6.3	−7.7
Processed	.161	16.4	30.1*	23.5*	8.1	−26.5*
Other	.110	−45.4*	−2.6	30.1	65.0*	2.6
Cottage cheese	.183	−76.2*	−30.2*	−19.7	−21.8*	2.2
Sour cream and dips	.018	−33.5	39.7	80.4*	35.4*	−7.5
Table fat	.268	−39.8*	−34.4*	−21.3*	−13.3*	10.5*
Butter	.076	−54.8*	−44.7*	−19.2	22.2*	−2.5
Margarine	.175	−24.6*	−23.9*	−19.0*	−31.1*	17.5*

Note: *denotes significant difference at the 0.10 level.

[1]Factors other than age composition are held constant at their sample means.
[2]Includes margarine and cream substitutes.
[3]Excludes margarine and cream substitutes.

Table 12—Simulated weekly per person dairy expenditures by food stamp status[1]

Item	Food stamp nonrecipient (Base)	Food stamp recipient (Percentage change from base)
	Dollars	*Percent*
Dairy and related products[2]	2.196	12.9*
Dairy products[3]	2.036	13.0*
Fresh milk	.935	20.8*
Whole	.622	25.3*
Other	.273	−3.5
Processed milk	.135	5.1
Canned	.060	9.8
Dry	.063	7.7
Cream	.028	−12.9
Cream substitutes	.017	−30.4*
Frozen desserts	.229	−2.7
Cheese	.507	10.2*
Natural American and cheddar	.177	−.3
Processed	.166	17.5*
Other	.132	−24.2*
Cottage cheese	.154	−16.6*
Sour cream and dips	.022	−24.3
Table fat	.239	4.6
Butter	.073	−22.0*
Margarine	.151	13.2*

Note: *denotes significant difference at the 0.10 level.

[1]Factors other than food stamp status are held constant at their sample means.
[2]Includes margarine and cream substitutes.
[3]Excludes margarine and cream substitutes.

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Appendix table 1—Weekly per person dairy expenditures by income quintile

Item	Income quintiles						
	All	I	II	III	IV	V	Not classified
	Dollars						
Dairy and related products[1]	2.08	1.92	1.96	2.03	2.08	2.33	2.07
Dairy products[2]	1.93	1.76	1.81	1.88	1.94	2.19	1.92
Fresh milk	.91	.89	.89	.90	.93	.96	.90
Whole	.63	.73	.69	.64	.62	.58	.60
Other milk	.28	.16	.20	.26	.31	.38	.29
Processed milk	.11	.12	.13	.13	.10	.10	.09
Canned	.06	.08	.07	.07	.05	.04	.05
Dry	.05	.04	.06	.05	.05	.06	.04
Cream	.02	.02	.02	.02	.02	.03	.02
Cream substitutes	.02	.01	.01	.02	.01	.02	.02
Frozen desserts	.21	.19	.17	.20	.22	.26	.21
Cheese	.45	.36	.40	.42	.45	.54	.46
Natural American and cheddar	.15	.14	.15	.15	.15	.17	.16
Processed	.16	.15	.15	.15	.16	.17	.15
Other	.14	.07	.10	.12	.14	.20	.15
Cottage cheese	.13	.11	.13	.12	.12	.16	.14
Sour cream and dips	.02	.01	.01	.02	.02	.04	.02
Table fat	.21	.20	.20	.20	.20	.23	.21
Butter	.07	.06	.06	.07	.08	.10	.08
Margarine	.13	.15	.14	.13	.13	.13	.14

[1]Includes cream substitutes and margarine.
[2]Excludes cream substitutes and margarine.

Source: Based on data from 1977-78 NFCS.

Appendix table 2—Weekly per person dairy expenditures by household size

Item	Household size						
	All	1	2	3	4	5	6 or more
	Dollars						
Dairy and related products[1]	2.08	2.48	2.24	2.11	2.02	1.99	1.88
Dairy products[2]	93	2.30	2.05	1.96	1.88	1.86	1.76
Fresh milk	.91	.91	.82	.91	.91	.99	.96
Whole	.63	.64	.54	.62	.63	.69	.70
Other milk	.28	.27	.28	.28	.26	.30	.26
Processed milk	.11	.11	.10	.12	.11	.10	.11
Canned	.06	.04	.04	.07	.07	.05	.07
Dry	.05	.06	.06	.05	.04	.05	.04
Cream	.02	.05	.04	.02	.02	.02	.02
Cream substitutes	.02	.02	.02	.01	.01	.01	.01
Frozen desserts	.21	.23	.23	.21	.22	.20	.20
Cheese	.45	.62	.54	.47	.42	.39	.34
Natural American and cheddar	.15	.22	.19	.16	.13	.13	.12
Processed	.16	.18	.16	.17	.15	.15	.13
Other	.14	.21	.18	.14	.13	.11	.09
Cottage cheese	.13	.26	.20	.12	.11	.09	.07
Sour cream and dips	.02	.03	.03	.03	.02	.02	.01
Table fat	.21	.27	.26	.22	.19	.18	.15
Butter	.07	.10	.10	.08	.07	.06	.05
Margarine	.13	.17	.17	.14	.12	.12	.11

[1]Includes cream substitutes and margarine.
[2]Excludes cream substitutes and margarine.

Source: Based on data from 1977-78 NFCS.

Appendix table 3—Weekly per person dairy expenditures by season

Item	All	Season			
		Spring	Summer	Fall	Winter
			Dollars		
Dairy and related products[1]	2.08	2.00	2.12	2.08	2.13
Dairy products[2]	1.93	1.86	1.97	1.93	1.97
Fresh milk	.91	.88	.91	.92	.94
Whole	.63	.60	.63	.64	.66
Other	.28	.28	.28	.28	.28
Processed milk	.11	.09	.11	.11	.12
Canned	.06	.05	.06	.06	.06
Dry	.05	.04	.04	.05	.06
Cream	.02	.02	.02	.03	.02
Cream substitutes	.02	.02	.01	.01	.02
Frozen desserts	.21	.22	.25	.19	.19
Cheese	.45	.42	.44	.45	.48
Natural American and cheddar	.15	.14	.16	.16	.17
Processed	.16	.15	.15	.15	.17
Other	.14	.13	.13	.14	.14
Cottage cheese	.13	.14	.14	.12	.13
Sour cream and dips	.02	.02	.02	.02	.02
Table fat	.21	.19	.21	.22	.22
Butter	.07	.06	.07	.08	.08
Margarine	.13	.12	.14	.14	.14

[1]Includes cream substitutes and margarine.
[2]Excludes cream substitutes and margine.

Source: Base on data from the 1977-78 NFCS.

Appendix table 4—Weekly per person dairy expenditures by region

Item	All	Region			
		Northeast	North Central	South	West
			Dollars		
Dairy and related products[1]	2.08	2.33	2.06	1.81	2.24
Dairy products[2]	1.93	2.19	1.90	1.66	2.09
Fresh milk	.91	.96	.91	.87	.91
Whole	.63	.77	.49	.69	.55
Other	.28	.19	.42	.18	.36
Processed milk	.11	.10	.09	.11	.14
Canned	.06	.04	.04	.08	.07
Dry	.05	.06	.05	.03	.07
Cream	.02	.03	.03	.01	.03
Cream substitutes	.02	.02	.02	.01	.02
Frozen desserts	.21	.26	.21	.19	.19
Cheese	.45	.52	.43	.35	.54
Natural American and cheddar	.15	.12	.15	.15	.23
Processed	.16	.17	.16	.15	.14
Other	.14	.23	.13	.05	.17
Cottage cheese	.13	.17	.14	.07	.17
Sour cream and dips	.02	.03	.02	.01	.03
Table fat	.21	.24	.22	.17	.21
Butter	.07	.12	.07	.04	.07
Margarine	.13	.12	.15	.13	.13

[1]Includes cream substitutes and margarine.
[2]Excludes cream substitutes and margine.

Source: Base on data from the 1977-78 NFCS.

Appendix table 5—Weekly per person dairy expenditures by urbanization

Item	Urbanization			
	All	Central city	Noncentral city	NonSMSA
	Dollars			
Dairy and related products[1]	2.08	2.03	2.18	2.02
Dairy products[2]	1.93	1.89	2.03	1.86
Fresh milk	.91	.86	.92	.94
Whole	.63	.64	.60	.66
Other	.28	.22	.32	.29
Processed milk	.11	.10	.10	.12
Canned	.06	.06	.05	.07
Dry	.05	.05	.05	.05
Cream	.02	.02	.03	.02
Cream substitutes	.02	.01	.02	.02
Frozen desserts	.21	.19	.23	.21
Cheese	.45	.47	.49	.38
Natural American and cheddar	.15	.15	.15	.16
Processed	.16	.16	.16	.15
Other	.14	.16	.17	.08
Cottage cheese	.13	.14	.15	.11
Sour cream and dips	.02	.02	.03	.02
Table fat	.21	.21	.22	.20
Butter	.07	.08	.09	.05
Margarine	.13	.12	.13	.15

[1]Includes cream substitutes and margarine.
[2]Excludes cream substitutes and margine.

Source: Base on data from the 1977-78 NFCS.

Appendix table 6—Weekly per person dairy expenditures by race

Item	Race			
	All	White	Black	Other
	Dollars			
Dairy and related products[1]	2.08	2.19	1.44	1.86
Dairy products[2]	1.93	2.03	1.33	1.76
Fresh milk	.91	.95	.67	.94
Whole	.63	.63	.60	.87
Other	.28	.32	.07	.07
Processed milk	.11	.11	.11	.11
Canned	.06	.05	.09	.08
Dry	.05	.06	.02	.03
Cream	.02	.03	.01	.01
Cream substitutes	.02	.02	.01	.01
Frozen desserts	.21	.22	.16	.15
Cheese	.45	.48	.28	.37
Natural American and cheddar	.15	.16	.13	.13
Processed	.16	.16	.11	.13
Other	.14	.15	.03	.11
Cottage cheese	.13	.15	.04	.11
Sour cream and dips	.02	.03	.00	.01
Table fat	.21	.22	.16	.16
Butter	.07	.08	.05	.06
Margarine	.13	.14	.10	.10

[1]Includes cream substitutes and margarine.
[2]Excludes cream substitutes and margine.

Source: Base on data from the 1977-78 NFCS.

Appendix table 7—Weekly per capita food expenditures and the percentage spent on at-home food purchases

Demographic group	Food expenditures			
	Total	At home	Away	Percentage at home
	Dollars			*Percent*
All	19.25	14.24	5.01	74.0
Season:				
Spring	19.45	14.10	5.35	72.5
Summer	19.21	14.17	5.04	73.8
Fall	18.93	14.03	4.90	74.1
Winter	19.41	14.65	4.76	75.5
Income quintile:				
I	15.96	13.70	2.26	85.8
II	17.17	13.62	3.54	79.3
III	18.31	13.68	4.63	74.7
IV	19.55	14.20	5.35	72.6
V	23.34	15.58	7.76	66.8
Urbanization:				
Central city	20.41	15.19	5.23	74.4
Suburban	20.32	14.59	5.73	71.8
NonSMSA	16.90	12.96	3.94	76.7
Region:				
Northeast	21.99	16.17	5.82	73.5
North Central	18.25	13.65	4.60	74.8
South	17.34	13.10	4.24	75.5
West	20.22	14.39	5.82	71.2
Race:				
White	19.78	14.39	5.39	72.8
Black	16.45	13.37	3.08	81.3
Nonwhite-nonblack	16.98	13.80	3.18	81.3
Household size:				
1	27.40	18.32	9.08	66.8
2	23.16	16.64	6.52	71.8
3	20.06	14.85	5.21	74.0
4	17.94	13.41	4.53	74.7
5	16.84	12.71	4.14	75.4
6 or more	14.55	11.68	2.88	80.2

Source: Based on data from the 1977-78 NFCS.

Appendix table 8—Dairy model: Parameter estimates and summary statistics[1]

Independent variables	Dairy and related products	Dairy	Fresh milk	Whole milk	Other milk
Constant	1.2426*** (.1304)	1.1021*** (.1281)	0.7510*** (.0804)	0.9602*** (.1008)	−1.3709*** (.1303)
North Central	−.2814*** (.0397)	−.3124*** (.0391)	−.0641*** (.0244)	−.4442*** (.0309)	.5983*** (.0393)
South	−.3546*** (.0377)	−.3702*** (.0371)	.0063 (.0232)	−.0648** (.0286)	.2270*** (.0390)
West	−.1130*** (.0427)	−.1218*** (.0420)	−.0469* (.0263)	−.3826*** (.0333)	5558*** (.0423)
Suburban	.0483 (.0354)	.0469 (.0347)	.0104 (.0218)	−.0268 (.0274)	.1205*** (.0349)
Nonmetropolitan	−.0523 (.0363)	−.0730** (.0357)	.0347 (.0224)	.0145 (.0281)	.0765** (.0361)
Black	−.6076*** (.0466)	−.5721*** (.0458)	−.3401*** (.0288)	−.1215*** (.0353)	−.4606*** (.0509)
Nonwhite-nonblack	−.1620** (.0807)	−.1434* (.0792)	.0077 (.0495)	.3404*** (.0605)	−.9966*** (.1098)
Log income	.1675*** (.0249)	.1678*** (.0245)	−.0101 (.0153)	−.1270*** (.0193)	.1950*** (.0247)
Summer quarter	.1599*** (.0397)	.1402*** (.0390)	.0555** (.0245)	.0671** (.0308)	.0023 (.0388)
Fall quarter	.1617*** (.0383)	.1385*** (.0376)	.0846*** (.0236)	.1221*** (.0297)	−.0227 (.0376)
Winter quarter	.1446*** (.0388)	.1213*** (.0381)	.0994*** (.0239)	.1246*** (.0301)	−.0060 (.0380)
Family size (inverse)	.4754*** (.0686)	.4561*** (.0674)	.0884** (.0424)	.1340** (.0533)	−.4543*** (.0688)
Guest meals	.2743*** (.0130)	.2503*** (.0127)	.0745*** (.0079)	.0495*** (.0098)	.0715*** (.0119)
Percentage age 0-2	.3461** (.1581)	.4038*** (.1554)	.3538*** (.0970)	.0509 (.1223)	.2606* (.1558)
Percentage age 3-12	−.1354 (.0934)	−.0772 (.0918)	.2069*** (.0574)	.1992*** (.0719)	−.1737* (.0928)
Percentage age 13-19	.3888*** (.0977)	.4323*** (.0960)	.4554*** (.0601)	.3814*** (.0750)	.0739 (.0962)
Percentage age 20-39	−.0611 (.0473)	.0091 (.0465)	−.0388 (.0292)	−.0462 (.0369)	−.0412 (.0467)
Percentage age 65 and over	.0022 (.0499)	−.0395 (.0490)	.0032 (.0308)	−.0487 (.0389)	.1301*** (.0492)
Food stamp program participation	.2956*** (.0579)	.2788*** (.0569)	.2188*** (.0356)	.2242*** (.0437)	−.0261 (.0635)
Summary statistics:					
Mean square error	1.7190	1.6459	.5792	.5421	.2629
Probability of purchase at means	.9510	.9399	.8630	.6735	.3436
Observed nonlimit values (proportion)	.9944	.9898	.9303	.6958	.3609
Income elasticity (total)	.0721	.0770	−.0092	−.1341	.2640

Continued—

See footnotes at end of table.

Appendix table 8—Dairy model: Parameter estimates and summary statistics—Continued[1]

Independent variables	Frozen desserts	Cheese	Natural American and cheddar cheese	Processed cheese	Other cheese
Constant	−0.2227*** (.0683)	−0.1149 (.0698)	−0.6680*** (.0889)	−0.2589*** (.0616)	−1.0225*** (.1135)
North Central	−.0614*** (.0205)	−.1195*** (.0210)	.1104*** (.0275)	−.0374** (.0181)	−.3428*** (.0317)
South	−.0870*** (.0196)	−.1978*** (.0200)	.1042*** (.0262)	−.0459*** (.0173)	−.6804*** (.0328)
West	−.0827*** (.0222)	−.0118 (.0226)	.3506*** (.0286)	−.1635*** (.0202)	−.2416*** (.0334)
Suburban	.0541*** (.0185)	.0253 (.0188)	.0436* (.0240)	−.0052 (.0164)	.0271 (.0292)
Nonmetropolitan	.0246 (.0191)	−.0934*** (.0195)	.0480* (.0248)	−.0508*** (.0171)	−.2254*** (.0320)
Black	−.0637** (.0249)	−.1935*** (.0254)	−.0589* (.0325)	−.1195*** (.0223)	−.4723*** (.0501)
Nonwhite-nonblack	−.1167*** (.0438)	−.0665 (.0429)	−.1120** (.0566)	−.0268 (.0376)	−.1206* (.0685)
Log income	.0803*** (.0131)	.1217*** (.0134)	.0527*** (.0170)	.0497*** (.0118)	.2198*** (.0219)
Summer quarter	.0454** (.0204)	.0369* (.0212)	.0154 (.0271)	.0319* (.0186)	−.0260 (.0342)
Fall quarter	−.0578*** (.0199)	.0597*** (.0204)	.0408 (.0260)	.0348* (.0180)	.0261 (.0327)
Winter quarter	−.0905*** (.0203)	.0567*** (.0207)	.0410 (.0264)	.0695*** (.0181)	−.0066 (.0333)
Family size (inverse)	−.2479*** (.0368)	.0181 (.0370)	−.1205** (.0475)	−.0872*** (.0330)	−.3152*** (.0607)
Guest meals	.0681*** (.0065)	.0997*** (.0068)	.0520*** (.0083)	.0416*** (.0058)	.0895*** (.0100)
Percentage age 0-2	−.2019** (.0834)	−.2206*** (.0839)	−.1077 (.1074)	.0606 (.0724)	−.2824** (.1367)
Percentage age 3-12	.0761 (.0485)	−.0609 (.0498)	−.1003 (.0635)	.1067** (.0432)	−.0130 (.0803)
Percentage age 13-19	.1035** (.0508)	.0762 (.0522)	.0931 (.0656)	.0846* (.0456)	.1348 (.0845)
Percentage age 20-39	−.1001*** (.0253)	.1521*** (.0252)	.0311 (.0322)	.0305 (.0221)	.2647*** (.0397)
Percentage age 65 and over	.0670** (.0263)	−.1026*** (.0271)	−.0398 (.0346)	−.1138*** (.0243)	.0128 (.0454)
Food stamp program participation	−.0132 (.0311)	.0707** (.0314)	−.0014 (.0412)	.0648** (.0272)	−.1393** (.0595)
Summary statistics:					
Mean square error	.1311	.3147	.1157	.0819	.1383
Probability of purchase at means	.4694	.7098	.3365	.4225	.2400
Observed nonlimit values (proportion)	.4899	.7701	.3454	.4339	.2848
Income elasticity (total)	.1679	.1712	.1049	.1264	.4252

See footnotes at end of table.

Continued—

Appendix table 8—Dairy model: Parameter estimates and summary statistics—Continued[1]

Independent variables	Processed milk	Canned milk	Dry milk	Cream	Cream substitutes
Constant	−0.5407*** (.1158)	−0.9143*** (.1508)	−0.9078*** (.1293)	−1.0358*** (.1016)	−0.4675*** (.0611)
North Central	−.0602* (.0358)	.0397 (.0501)	−.1019*** (.0381)	.0544* (.0280)	.0240 (.0173)
South	.0835** (.0333)	.3785*** (.0446)	−.1770*** (.0370)	−.1818*** (.0296)	−.0469*** (.0174)
West	.1615*** (.0374)	.3057*** (.0509)	.0682* (.0398)	.0386 (.0304)	−.0315 (.0196)
Suburban	−.0397 (.0317)	−.0669 (.0421)	−.0095 (.0350)	.0284 (.0266)	.0272* (.0165)
Nonmetropolitan	.0872*** (.0318)	.1255*** (.0410)	.0673* (.0356)	.0217 (.0276)	.0228 (.0170)
Black	.0436 (.0402)	.3131*** (.0477)	−.3424*** (.0533)	−.1193*** (.0414)	−.1641*** (.0274)
Nonwhite-nonblack	−.2522*** (.0776)	.0174 (.0936)	−.5119*** (.0996)	−.2292*** (.0762)	−.1392*** (.0478)
Log income	−.0083 (.0220)	−.0563** (.0285)	−.0328 (.0246)	−.0980*** (.0194)	.0320*** (.0117)
Summer quarter	−.0452 (.0358)	.0285 (.0457)	−.0973** (.0409)	−.0214 (.0303)	−.0520*** (.0186)
Fall quarter	.0880*** (.0335)	.0852** (.0434)	.0772** (.0376)	.0456 (.0284)	−.0149 (.0173)
Winter quarter	.0699** (.0340)	.0060 (.0447)	.1346*** (.0374)	−.0055 (.0294)	.0034 (.0174)
Family size (inverse)	−.3506*** (.0629)	−.5830*** (.0851)	−.2130*** (.0697)	−.2113*** (.0525)	−.1615*** (.0328)
Guest meals	.0428*** (.0109)	.0908*** (.0128)	−.0172 (.0139)	.0465*** (.0082)	.0327*** (.0049)
Percentage age 0-2	1.4777** (.1295)	2.0276*** (.1574)	.1685 (.1531)	−.1279 (.1264)	−.0627 (.0777)
Percentage age 3-12	−.1958** (.0827)	−.3073*** (.1077)	−.0391 (.0919)	−.0596 (.0719)	−.0398 (.0435)
Percentage age 13-19	.0589 (.0859)	−.0313 (.1108)	.1359 (.0952)	−.0704 (.0747)	−.0510 (.0452)
Percentage age 20-39	−.1208*** (.0439)	−.2659*** (.0612)	−.0091 (.0476)	−.1349*** (.0368)	−.1396*** (.0235)
Percentage age 65 and over	.0975** (.0445)	.1578*** (.0575)	.0473 (.0499)	.1453*** (.0362)	.0824*** (.0219)
Food stamp program participation	.0269 (.0501)	.0452 (.0608)	.0328 (.0599)	−.0385 (.0514)	−.0597* (.0321)
Summary statistics:					
Mean square error	.1453	.0866	.0592	.0175	.0062
Probability of purchase at means	.2431	.1196	.1370	.0955	.0929
Observed nonlimit values (proportion)	.2732	.1489	.1520	.1087	.1060
Income elasticity (total)	−.0155	−.1176	.0746	.3497	.1891

See footnotes at end of table.

Continued—

Appendix table 8—Dairy model: Parameter estimates and summary statistics—Continued[1]

Independent variables	Cottage cheese	Sour cream and dips	Table fat	Butter	Margarine
Constant	−0.6063*** (.0946)	−0.8480*** (.0761)	0.2036*** (.0230)	−0.3449*** (.0634)	0.1221*** (.0186)
North Central	−.0259 (.0273)	−.0066 (.0210)	−.0352*** (.0070)	−.2193*** (.0181)	.0402*** (.0056)
South	−.3540*** (.0277)	−.1183*** (.0217)	−.0753*** (.0066)	−.3604*** (.0181)	.0298*** (.0054)
West	.0343 (.0289)	.0155 (.0221)	−.0543*** (.0075)	−.2269*** (.0196)	.0248*** (.0061)
Suburban	.0085 (.0251)	.0217 (.0192)	.0008 (.0062)	−.0005 (.0166)	−.0005 (.0050)
Nonmetropolitan	−.0256 (.0264)	−.0617*** (.0211)	−.0061 (.0064)	−.1192*** (.0180)	.0259*** (.0051)
Black	−.5012*** (.0418)	−.2962*** (.0392)	−.0343*** (.0082)	.0337 (.0232)	−.0433*** (.0066)
Nonwhite-nonblack	−.1103* (.0594)	−.1242** (.0496)	−.0330** (.0143)	−.0507 (.0394)	−.0214* (.0116)
Log income	.1180*** (.0181)	.0945*** (.0146)	.0127*** (.0044)	.0701*** (.0123)	−.0044 (.0035)
Summer quarter	.0155 (.0282)	.0038 (.0224)	.0338*** (.0070)	.0100 (.0194)	.0269*** (.0057)
Fall quarter	−.0507* (.0275)	.0093 (.0216)	.0511*** (.0067)	.0415** (.0186)	.0335*** (.0054)
Winter quarter	−.0365 (.0278)	.0188 (.0218)	.0445*** (.0068)	.0332* (.0189)	.0302*** (.0055)
Family size (inverse)	−.0100 (.0494)	−.2311*** (.0415)	−.0137 (.0121)	−.1129*** (.0332)	−.0270*** (.0098)
Guest meals	.0279*** (.0088)	.0537*** (.0059)	.0364*** (.0023)	.0378*** (.0057)	.0217*** (.0018)
Percentage age 0-2	−.6264*** (.1220)	−.0804 (.0907)	−.1357*** (.0278)	−.2147*** (.0775)	−.0569** (.0224)
Percentage age 3-12	−.1774*** (.0679)	.0699 (.0521)	−.1154*** (.0164)	−.1637*** (.0456)	−.0552*** (.0132)
Percentage age 13-19	−.1100 (.0707)	.1262** (.0539)	−.0689*** (.0172)	−.0615 (.0479)	−.0432*** (.0138)
Percentage age 20-39	−.1230*** (.0337)	.0632** (.0263)	−.0423*** (.0083)	.0606*** (.0223)	−.0735*** (.0068)
Percentage age 65 and over	.0114 (.0354)	−.0157 (.0311)	.0320*** (.0088)	−.0074 (.0247)	.0369*** (.0071)
Food stamp program participation	−.0875* (.0476)	−.0569 (.0425)	.0132 (.0102)	−.0704** (.0306)	.0257*** (.0082)
Summary statistics:					
Mean square error	.1272	.0091	.0465	.0360	.0227
Probability of purchase at means	.3017	.0907	.8321	.2482	.7539
Observed nonlimit values (proportion)	.3332	.1109	.9194	.2658	.7866
Income elasticity (total)	.2398	.4513	.0441	.2409	−.0219

[1]The dependent variables are measured in dollars per person per week of food used from household supplies. Sample means of the independent variables are: North Central, 0.2385; South, 0.3236; West, 0.2366; suburban, 0.3788; nonmetropolitan, 0.3404;

black, 0.1025; other race, 0.02725; log income (after tax in dollars per week including bonus value of food stamp transfers), 4.2763; summer quarter, 0.2233; fall quarter, 0.2750; winter quarter, 0.2598; family size (inverse), 0.4390; guest meals (per household member), 0.5063; percentage age 0-2, 0.0350; percentage age 3-12, 0.1250; percentage age 13-19, 0.1071; percentage age 20-39, 0.2992; percentage age 65 and over, 0.1528; food stamp program participation, 0.0554. ***denotes significance at the 0.01 level, **denotes significance at the 0.05 level, and *denotes significance at the 0.10 level. Numbers in parentheses are standard errors for the parameter estimates.

Source: 1977-78 NFCS.

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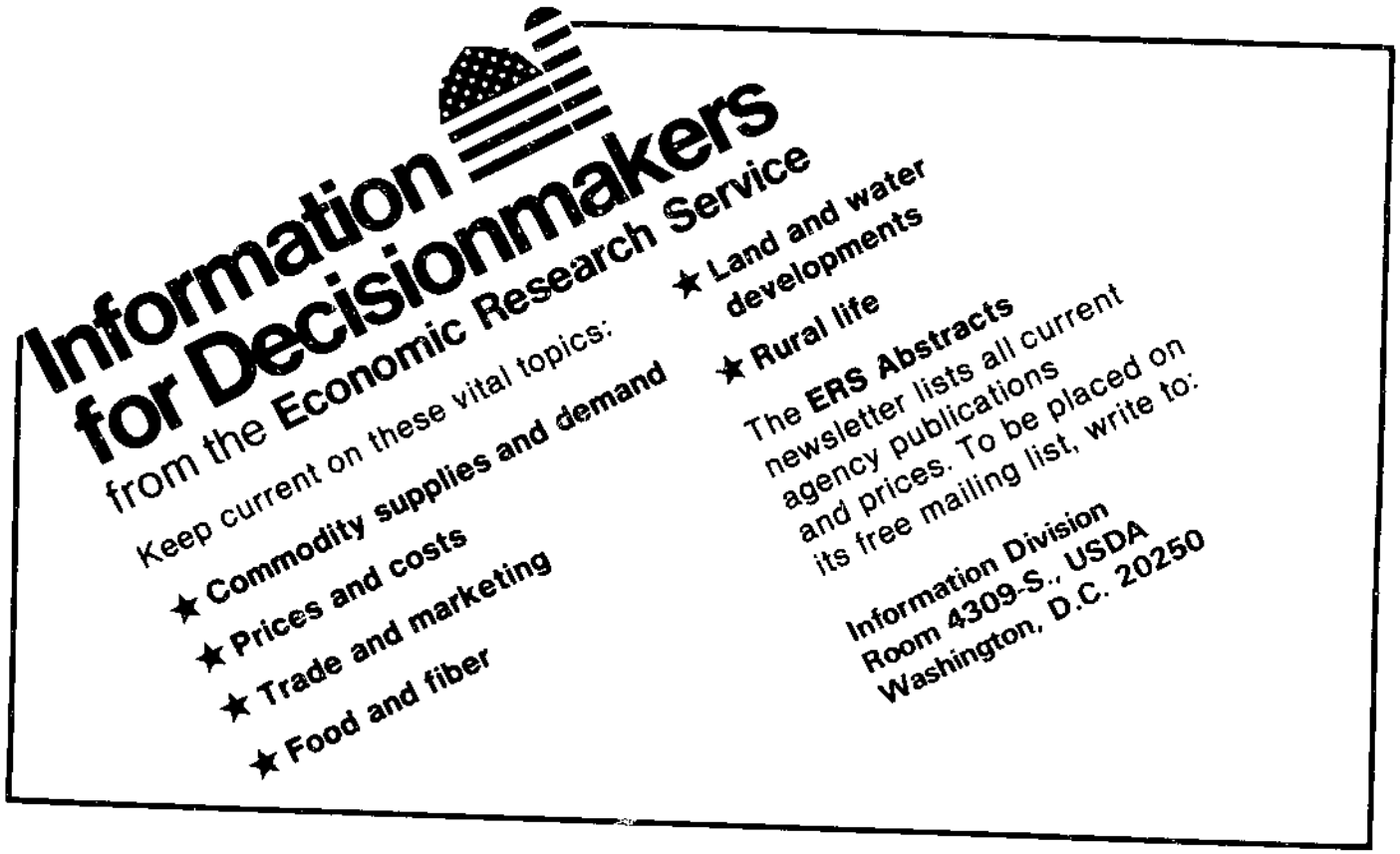

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