June 1993 A.E. Res. 93-3

ANALYSIS OF GENERIC DAIRY ADVERTISING SCENARIOS ON RETAIL, WHOLESALE, AND FARM MILK MARKETS

by

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Acknowledgements

Harry M. Kaiser is an associate professor and Olan D. Forker is a professor in the Department of Agricultural Economics at Cornell University. The authors would like to thank Les Meyers, Jim Blaylock, John Lenz, Tom Cox, Chin-Hwa Sun, Mike Wohlgenant, and members of the USDA Oversight Committee of the National Dairy Promotion and Research Board for useful comments on this research. The authors also wish to thank Jonell Blakeley for her assistance in preparing this report.

This research was partially funded by a cooperative agreement with the Commodity Economics Division of the Economic Research Service, U.S. Department of Agriculture. Funding was also provided by the dairy farmers of New York State under the authority of the New York State Milk Promotion Order and the New York State Department of Agriculture and Markets, and by the State of New York and the federal government through Hatch Project 522.

Abstract

An econometric model of the United States dairy industry is used to simulate the economic impact of alternative strategies in the generic advertising of dairy products. Advertising programs for fluid milk, cheese, and butter are considered. The historic quarterly advertising expenditure levels experienced during the period October 1984 through December 1990 are used as a basis of comparison. A national model enables the analyst to simultaneously estimate the impact of changes in advertising expenditures on price and volume of sales at retail, wholesale, and farm levels of trade. The impact on government purchases can also be estimated.

The simulations indicate that the largest impact of decreases or increases in advertising expenditures is on price. A 50 percent decrease in advertising expenditures (using the same allocation proportions among product categories constant) will result in a 6 percent decline in retail fluid milk price, a 2.4 percent decrease in retail cheese prices and a 1 percent decrease in retail butter price. On the other hand, a doubling of expenditures will result in retail price increases of 7.7 percent for fluid milk, 3.6 percent for cheese, and 1.3 percent for butter. At the farm level, overall increases in advertising expenditures will result in increases in the all farm milk price and increases in total production, cow numbers, and production per cow. As expenditure levels increase, the increased demand more than offsets the negative impact of increases in production volume so that producer returns overall continue to increase, but at a decreasing rate. Accounting for all impacts,

the rate of return is 4.6 percent at historic levels of advertising, 9.8 percent at 50 percent of historic levels, and 3.5 percent at advertising expenditure levels of 200 percent of historic levels.

The simulations indicate that a reallocation of advertising dollars toward fluid milk and away from cheese or butter will result in increases in producer returns, while a reallocation toward cheese or butter will result in decreases. This simulation process using the industry model can be used to estimate the economic impact of a large number of different expenditure strategies.

Analysis of Generic Dairy Advertising Scenarios on Retail, Wholesale, and Farm Milk Markets

Harry M. Kaiser and Olan D. Forker

Since 1984, dairy farmers have paid a mandatory assessment of 15 cents per hundred pounds of milk marketed in the continental U.S. to pay for a national demand management program to help increase consumer demand for milk and dairy products. Legislative authority for these assessments, which exceed $200 million annually, is contained in the Dairy and Tobacco Adjustment Act of 1983. The stated goals of this program are to increase consumption of milk and dairy products, enhance dairy farmer income, and reduce the amount of surplus milk purchased by the government under the dairy price support program. To increase milk and dairy product consumption, the National Dairy Promotion and Research Board was established to invest in generic dairy advertising and promotion, nutrition research, education, and new product development.

A substantial amount of research on the effectiveness of generic milk advertising has been conducted over the last 20 years. A report prepared for the International Dairy Federation summarizes the results of 47 studies of generic dairy advertising programs (Forker and Kinnucan, 1991). Twenty-seven studies were for advertising programs for fluid milk, ten for butter, five for cheese, three for cream, and one for yogurt. By country, 21 of the 47 studies were conducted in the U.S., 12 in the U.K., 12 in Canada, one in France, and one in the Netherlands. All of the studies provided some measure of the market impact of the generic advertising program being studied.

Methodology and estimation techniques have evolved to provide more reliable estimates of the economic relationship between sales or consumption and advertising expenditures, while controlling for other demand factors such as own price, income level, price of substitutes, and demographic factors. The early studies, and some of the more recent studies as well, involve single-equation demand functions estimated for single products and limited market areas (Kinnucan and Fearon, 1986; Kinnucan and Forker, 1986; Thompson and Eiler, 1975). These evolved into single-equation, single-product, multiple-market studies. Ward and Dixon (1989) combined data from 12 fluid milk markets for a pooled cross-section and time-series analysis. Liu and Forker (1990) developed single equations for three separate markets and used the equations to arrive at an optimal advertising allocation strategy among the three markets. In an earlier study, Liu and Forker (1988) incorporated a supply response function to account for any production response that might be generated by advertising-induced demand expansion. All of the fluid milk studies used aggregate market data to represent demand. In each of the fluid milk studies, models were specified as quantity-dependent, i.e., advertising was assumed to directly influence the volume of sales but not price.

There have also been studies that have estimated the impact of generic advertising of manufactured dairy products (e.g., cheese, butter, and cream) on demand (e.g., Blaylock and Blisard, 1990; Chang and Kinnucan, 1990; Kinnucan and Fearon, 1986; Lewandowski and Rojek, 1991; Liu et al., 1990, Strak and Gill, 1983; Yau, 1990). Two separate studies estimated a single demand equation for cheese which included a variable for generic cheese advertising expenditures (Blaylock and Blisard, 1990; Kinnucan and Fearon, 1986). A similar study was conducted for cream (Yau, 1990). Another study used multiple equations to account for the simultaneous impact of advertising on butter and other edible oils (Chang and Kinnucan, 1990). These and other studies have provided useful information to evaluate, ex post, the performance of generic dairy advertising programs. One shortcoming of most of these studies is that it is not possible to simultaneously determine the impact of generic advertising on price and quantity.

An industry model of the U.S. dairy sector was proposed by Liu et al. that could determine simultaneously the impact of advertising on price and quantity (Liu et al., 1990, 1991). The authors concluded that it was feasible to develop a multiple-product, multiple-market level model that would simultaneously account for the direct demand impact as well as the cross-product impacts of concurrent advertising programs for fluid milk and manufactured dairy products. The model concurrently takes into account the price and quantity impacts at three levels of trade -- retail, wholesale, and farm. The study was the first to explicitly incorporate the government price support program into the manufactured product market. A key conclusion is that generic advertising has different effects on market variables depending on whether the market is competitive or in a government-support regime where market prices are below support prices.

The purpose of this paper is to analyze the effectiveness of various generic advertising scenarios using a model similar to Liu et al. (1990, 1991). The model is based on a dynamic econometric model of the U.S. dairy industry estimated using quarterly data from 1975 through 1990. The econometric results are used to simulate the impacts of two sets of generic advertising scenarios on demand for milk and dairy products, farm and consumer prices, and producer welfare. In the first set of scenarios, total generic expenditure levels are varied from 5% to 200% of their historical values. The purpose of simulating these scenarios is to determine the marginal impacts of generic advertising based on alternative expenditure levels. The second scenario holds constant total generic advertising expenditures, but reallocates the revenue among fluid milk, cheese, and butter to determine which of the products has the largest consumption and price response to advertising. In this case, four scenarios are examined: baseline (historical) generic advertising, heavy generic fluid milk advertising, heavy generic cheese advertising, and heavy generic butter advertising. The purpose of the second set of scenarios is to see whether reallocation of existing advertising revenue can further increase farm prices and welfare, and lower government purchases of dairy products.

The Conceptual Model

The econometric model presented here is similar in structure to the Liu et al. (1990, 1991) industry model, with two importance differences. First, while Liu et al. (1990, 1991) classified all manufactured products into one category (Class II), the present model disaggregates manufactured products into three classes: frozen products, cheese, and butter. This greater degree of product disaggregation provides for additional insight into the impacts of advertising on individual product demand, e.g., cheese demand. Second, instead of a raw milk supply function for the farm market, the current model disaggregates farm milk supply into cow number and production per cow components. This decomposition of milk supply allows for more information on how the two components of milk supply are affected by generic advertising, as well as other economic variables.

In the farm market, Grade A (fluid eligible) milk is produced by farmers and sold to wholesalers. The wholesale market is disaggregated into four submarkets: fluid milk, frozen products, cheese, and butter.[1] Wholesalers process the milk into these four dairy products and sell them to retailers, who then sell the products to consumers.

It is assumed that the two major federal programs that regulate the dairy industry (federal milk marketing orders and the dairy price support program) are in effect. Since this is a national model, it is assumed that there is one federal milk marketing order regulating all milk marketed in the nation. This program is incorporated by constraining the prices wholesalers pay for raw milk to be the minimum class prices. For example, fluid milk wholesalers pay the higher Class I price, while cheese wholesalers pay the lower Class III price.[2] The dairy price support program is incorporated into the model by constraining the wholesale cheese and butter prices to be greater-than-or-equal-to the government purchase prices. With the government offering to buy unlimited quantities of storable manufactured dairy products at announced purchase prices, the program indirectly supports the farm milk price by increasing farm level milk demand. A conceptual overview of the model is presented in Figure 1.

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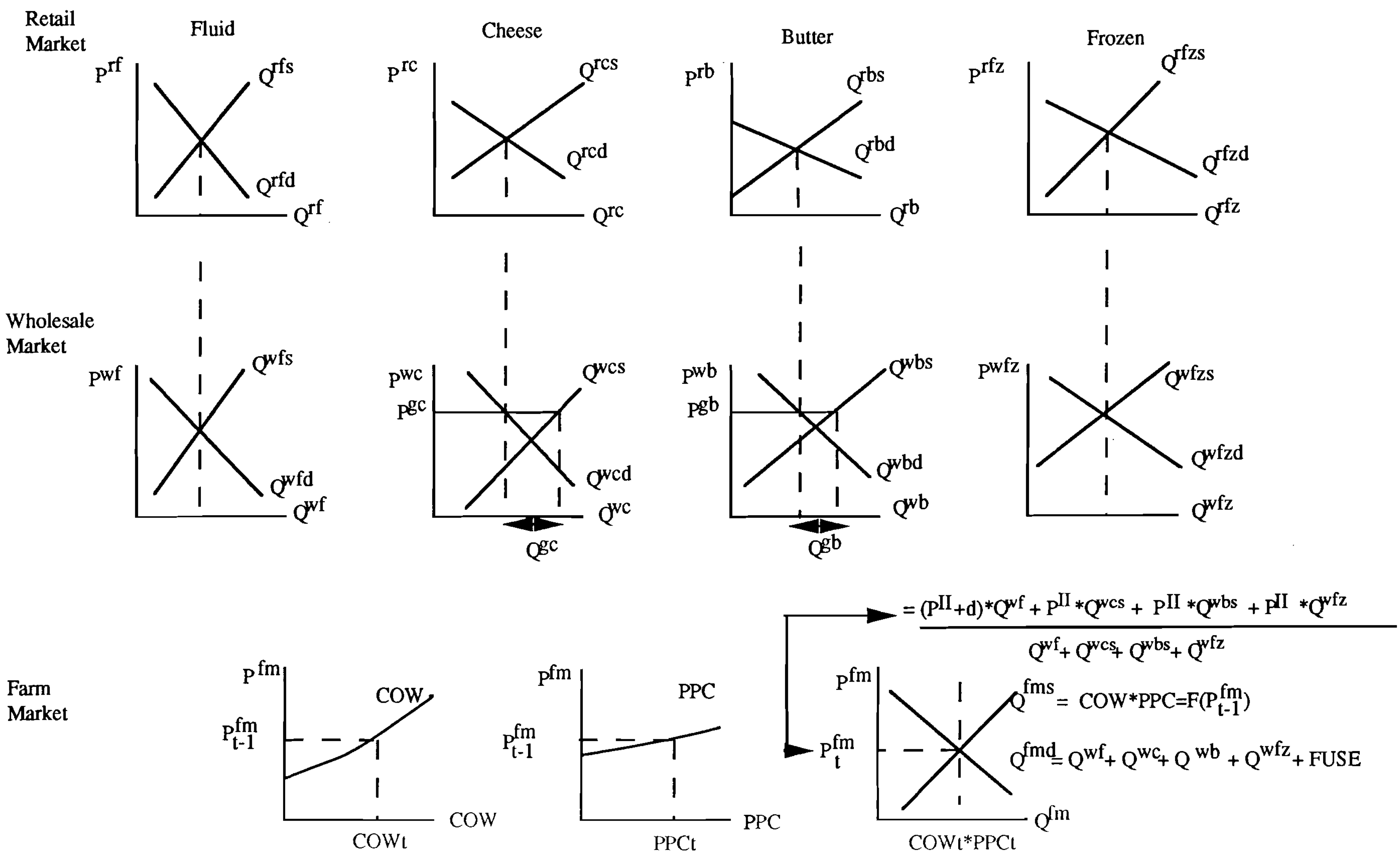
[1]All quantities in the model are expressed on a milkfat equivalent basis. Consequently, nonfat dry milk is not considered in the model.

[2]Most federal milk marketing orders utilize three product classes with Class I being fluid products, Class II being soft dairy products, and Class III being hard dairy products. A two class system is used in this study, with all fluid products considered Class I and all manufactured products considered Class II.

Figure 1. Conceptual Model of the Dairy Industry (All Quantities on a Milk Equivalent Basis).



Retail markets are defined by sets of supply and demand functions and equilibrium conditions that require supply to be equal to demand. Since the market is disaggregated into fluid milk, frozen products, cheese, and butter, there are four sets of these equations, with each set having the following general specification:

(1.1) $Q^{rd} = f(P^r|S^{rd})$,

(1.2) $Q^{rs} = f(P^r|S^{rs})$,

(1.3) $Q^{rs} = Q^{rd} \equiv Q^r$,

where: Q^{rd} and Q^{rs} are retail demand and supply, respectively, P^r is the retail own price, S^{rd} is a vector of retail demand shifters including generic and brand advertising, S^{rs} is a vector of retail supply shifters including the wholesale own price, and Q^r is the equilibrium retail quantity.

The wholesale market is also defined by four sets of supply and demand functions and equilibrium conditions. The wholesale fluid milk and frozen product markets have the following general specification:

(2.1) $Q^{wd} = Q^r$,

(2.2) $Q^{ws} = f(P^w|S^{ws})$,

(2.3) $Q^{ws} = Q^{wd} \equiv Q^w \equiv Q^r$,

where: Q^{wd} and Q^{ws} are wholesale demand and supply, respectively, P^w is the wholesale own price, and S^{ws} is a vector of wholesale supply shifters. In the wholesale fluid milk supply equation, S^{ws} includes the Class I price, which equals the Class II milk price (i.e., the Minnesota-Wisconsin price) plus a fixed fluid milk differential. In the frozen products, cheese, and butter wholesale supply functions, S^{ws} includes the Class II price which is the most important variable cost to dairy processors. Note that the wholesale-level demand functions do not have to be estimated since the equilibrium conditions constrain wholesale demand to be equal to the equilibrium retail quantity. The assumption that wholesale demand equals retail quantity implies a fixed-proportions production technology. Recent research by Wohlgenant and Haidacher (1989) suggest that this may not be a realistic assumption. However, the data used as a proxy for national demand are commercial disappearance statistics which do not distinguish between wholesale and retail levels. Consequently this assumption is necessary.

The wholesale cheese and butter markets are where the direct impacts of the dairy price support program occur. It is at this level that the Commodity Credit Corporation (CCC) provides an alternative source of demand at announced purchase prices. Consequently, the equilibrium conditions for the butter and cheese wholesale markets are different than those for the fluid milk and frozen wholesale markets. The wholesale cheese and butter markets have the following general specification:

(3.1) $Q^{wd} = Q^{r}$,

(3.2) $Q^{ws} = f(P^{w} | S^{ws})$,

(3.3) $Q^{ws} = Q^{wd} + \Delta INV + QSP \equiv Q^{w}$,

where: Q^{wd} and Q^{ws} are wholesale demand and supply, respectively, P^{w} is the wholesale own price, S^{ws} is a vector of wholesale supply shifters including the Class II milk price, Δ INV is change in commercial inventories, QSP is quantity of product sold by specialty plants to the government, and Q^{w} is the equilibrium wholesale quantity. The variables ΔINV and QSP represent a small proportion of total milk production and are assumed to be exogenous in this model.[3]

The dairy price support program is incorporated in the model by constraining the wholesale cheese and butter prices to be not less than their respective government purchase prices, i.e.:

(4.1) $P^{wc} \geq P^{gc}$,

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[3] There are cheese and butter plants that sell products only to the government regardless of the relationship between the wholesale market price and the purchase price. These are general balancing plants that remove excess milk from the market when supply is greater than demand and process the milk into cheese and butter, which is then sold to the government. Because of this, the quantity of milk purchased by the government was disaggregated into purchases from these specialized plants and other purchases. In a competitive regime, the "other purchases" are expected to be zero, while the purchases from specialty plants may be positive. The QSP_c and QSP_b variables were determined by computing the average amount of government purchases of cheese and butter during competitive periods, i.e., when the wholesale price was greater than the purchase price for these two products.

(4.2) $P^{wb} \geq P^{gb}$,

where: P^{gc} and P^{gb} are the government purchase prices for cheese and butter, respectively.

Because of the dairy price support program, four regimes are possible: (1) $P^{wc} > P^{gc}$ and $P^{wb} > P^{gb}$; (2) $P^{wc} > P^{gc}$ and $P^{wb} = P^{gb}$; (3) $P^{wc} = P^{gc}$ and $P^{wb} > P^{gb}$; or (4) $P^{wc} = P^{gc}$ and $P^{wb} = P^{gb}$. In the cheese and butter markets, specific versions of equilibrium condition (3.3) apply to the first regime, which is the competitive case. In the second case where the cheese market is competitive, but the butter market is not, the wholesale butter price is set equal to the government purchase price for butter and the equilibrium condition is changed to:

(3.3b) $Q^{wbs} = Q^{wbd} + \Delta INV_b + QSP_b + Q^{gb} \equiv Q^{wb}$,

where: Q^{gb} is government purchases of butter which becomes the new endogenous variable, replacing the wholesale butter price. For the third case where the butter market is competitive, but the cheese market is not, the wholesale cheese price is set equal to the government purchase price for cheese and the equilibrium condition is changed to:

(3.3c) $Q^{wcs} = Q^{wcd} + \Delta INV_c + QSP_c + Q^{gc} \equiv Q^{wc}$,

where: Q^{gc} is government purchases of cheese which becomes the new endogenous variable, replacing the wholesale cheese price. Finally, for the last case where both the cheese and the butter markets are not competitive, the wholesale cheese and butter prices are set equal to their respective government purchase prices and the equilibrium conditions are changed to (3.3b) and (3.3c).[4]

The farm raw milk market is disaggregated into a national cow number equation, a national average production per cow equation, and an identity that equates milk supply to the product of cow numbers and production per cow, i.e.:

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[4]Because the market structure is different under each of these four regimes, using conventional two-stage least squares to estimate equations (1.1) through (4.2) may result in selectivity bias. Theoretically, a switching simultaneous system regression procedure should be applied, which is described in Liu, et al (1990, 1991). However, this procedure is not used here because it is beyond the scope of this project. Applying this procedure to the level of disaggregation of this model's manufactured product market would have been extremely cumbersome, and the costs of doing so were judged to be greater than the potential benefits.

(5.1) $COW = f(E[P^{fm}]|S^{cow})$,

(5.2) $PPC = f(P^{fm}|S^{PPC})$,

(5.3) $Q^{fm} = COW*PPC$,

where: COW is the number of dairy cows in the U.S., $E[P^{fm}]$ is the expected farm milk price, S^{cow} is a vector of cow supply shifters, PPC is average production per cow, S^{PPC} is a vector of production per cow shifters, and Q^{fm} is farm milk supply. Similar to Liu et al. (1990, 1991), it is assumed that farmers have naive price expectations, i.e., $E[P^{fm}]_t = P^{fm}_{t-1}$. Thus, the farm milk supply is predetermined and can be estimated using ordinary least squares. This assumption makes the industry model recursive, with the wholesale and retail markets forming a system, with the farm market being independent from the system.

The farm milk price is a weighted average of the Class prices for milk, with the weights equal to the utilization of milk among products:

(5.4) $$P^{fm} = \frac{(P^{II} + d) * Q^{wfs} + P^{II} * Q^{wfzs} + P^{II} * Q^{wcs} + P^{II} * Q^{wbs}}{Q^{wfs} + Q^{wfzs} + Q^{wcs} + Q^{wbs}}$$

where: P^{II} is the Class II price, d is the Class I fixed fluid milk differential (therefore the Class I price is equal to P^{II} + d), Q^{wfs} is wholesale fluid milk supply, Q^{wfs} is wholesale frozen product supply, Q^{wcs} is wholesale cheese supply, and Q^{wbs} is wholesale butter supply.

Finally, the model is closed by the following equilibrium condition:

(5.5) $Q^{fm} = Q^{wfs} + Q^{wfzs} + Q^{wcs} + Q^{wbs} + FUSE + OTHER$,

where FUSE is on-farm use of milk and OTHER is milk used in dairy products other than fluid milk, frozen products, butter, and cheese. Both of these variables represent a small share of total milk production and are treated as exogenous.

The Econometric Results

The retail and wholesale market equations are estimated simultaneously using two stage least squares and quarterly data from 1975 through 1990. The econometric package used is Micro

TSP. The farm market is estimated using ordinary least squares and quarterly data from 1970 through 1990 (all data are listed in the appendix). The retail-wholesale system has a shorter time series because advertising expenditures for the retail demand functions are not available prior to 1975. All equations in the model are specified in double-logarithm functional form. Estimation results are presented in Table 1 with t-values given in parentheses under each coefficient, and all variables are defined in Table 2. R^2 is the adjusted coefficient of determination and DW is the Durbin-Watson statistic.

The retail market demand functions are estimated on a per capita basis. Retail demand for each product is specified to be a function of the retail product price, the price of substitutes, per capita disposable income deflated by the Consumer Price Index, seasonal harmonic variables to account for seasonal demand, a time trend variable to capture changes in consumer tastes and preferences over time, and generic and brand advertising expenditures to measure the impact of advertising on retail demand. Per capita demand, lagged one and three quarters, is included for fluid milk demand to capture habit formation, but is not included in the other product demand functions. In all demand functions except butter, own prices are deflated by the price of substitute products. For the butter demand function, the own price is deflated by per capita income since the substitute price approach yields inferior statistical results.

The generic and brand advertising variables are specified two ways for each equation, with the form that resulted in the best statistical fit being used.[5] The first approach specifies advertising expenditures as a second-order polynomial distributed lag with both endpoint restrictions imposed. The second method simply uses current advertising expenditures as the explanatory variable. For the retail fluid milk demand function, generic and brand advertising are specified as a second-order polynomial distributed lag with both endpoint restrictions

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[5]All advertising expenditures (generic and brand) come from various issues of **Leading National Advertisers**. Due to their survey procedures, these expenditures are regarded as being lower than actual expenditures. However, alternative data sources for brand and generic advertising expenditures are not available. As is pointed out by Maddala (pp. 292-94), this creates an error in variable problem that may bias the estimated advertising coefficients downward (as opposed to upward bias, as one might intuitively expect). Consequently, some care should be exercised in interpreting these coefficients.

Table 1. Econometric Results for the Dairy Industry Model.

Retail Market

Retail Fluid Milk Demand:

$$\ln (Q^{rfd}/POP) = -\underset{(-2.48)}{0.845} - \underset{(-1.77)}{.024} \ln (P^{rf}/P^{bev}) + \underset{(2.97)}{.158} \ln (INC/CPI) - \underset{(-2.71)}{.031} \ln TREND$$

$$+\underset{(3.64)}{.024} SIN1 + \underset{(5.84)}{.029} COS1 + \underset{(3.81)}{.004} COS2 + \underset{(1.89)}{.255} \ln (Q^{rfd}/POP)_{-1} + \underset{(2.87)}{.330} \ln (Q^{rfd}/POP)_{-3}$$

$$+ \underset{(1.91)}{.0017} \ln DGFAD + \underset{(1.91)}{.0026} \ln DGFAD_{-1} + \underset{(1.91)}{.0030} \ln DGFAD_{-2} + \underset{(1.91)}{.0026} \ln DGFAD_{-3}$$

$$+ \underset{(1.91)}{.0017} \ln DGFAD_{-4} + \underset{(0.31)}{.0002} \ln DBFAD + \underset{(0.31)}{.0003} \ln DBFAD_{-1} + \underset{(0.31)}{.0003} \ln DBFAD_{-2}$$

$$+ \underset{(0.31)}{.0003} \ln DBFAD_{-3} + \underset{(0.31)}{.0002} \ln DBFAD_{-4}$$

R^2 = .96; DW = 1.97

Retail Frozen Demand:

$$\ln (Q^{rfzd}/POP) = -\underset{(-15.85)}{4.460} - \underset{(-2.02)}{.356} \ln (P^{rfz}/P^{foo}) + \underset{(.10)}{.008} \ln (INC/CPI) - \underset{(-31.08)}{.144} SIN1$$

$$-\underset{(-33.72)}{.157} COS1 - \underset{(-7.00)}{.023} COS2 + \underset{(1.53)}{.003} \ln (DBFZAD) + \underset{(1.53)}{.005} \ln (DBFZAD)_{-1}$$

$$+ \underset{(1.53)}{.005} \ln (DBFZAD)_{-2} + \underset{(1.53)}{.005} \ln (DBFZAD)_{-3} + \underset{(1.53)}{.003} \ln (DBFZAD)_{-4}$$

R^2 = .98; DW = 1.89

Retail Cheese Demand:

$$\ln (Q^{rcd}/POP) = -\underset{(-6.09)}{2.555} - \underset{(-1.41)}{.262} \ln (P^{rc}/P^{mea}) + \underset{(5.16)}{.733} \ln (INC/CPI) + \underset{(5.66)}{.267} DUM_{82.2}$$

$$-\underset{(-8.75)}{.424} DUM_{83.1} - \underset{(-2.23)}{.047} DTP + \underset{(.89)}{.007} SIN1 + \underset{(5.73)}{.033} COS2 + \underset{(.66)}{.0009} \ln DGCAD + \underset{(.66)}{.0015} \ln DGCAD_{-1}$$

$$+ \underset{(.66)}{.0017} \ln DGCAD_{-2} + \underset{(.66)}{.0015} \ln DGCAD_{-3} + \underset{(.66)}{.0009} \ln DGCAD_{-4} + \underset{(3.10)}{.013} \ln DBCAD$$

$$+ \underset{(3.10)}{.021} \ln DBCAD_{-1} + \underset{(3.10)}{.024} \ln DBCAD_{-2} + \underset{(3.10)}{.021} \ln DBCAD_{-3} + \underset{(3.10)}{.013} \ln DBCAD_{-4}$$

R^2 = .86; DW = 1.13

Table 1. (Continued).

Retail Butter Demand:

$$\ln (Q^{rbd}/POP) = -\underset{(-4.93)}{2.893} - \underset{(-1.85)}{.450} \ln (P^{rb}/INC) + \underset{(4.28)}{.077} \, COS1 + \underset{(2.36)}{.028} \, COS2 - \underset{(-3.76)}{.353} \, DUM_{80.2}$$

$$-\underset{(-4.36)}{.301} \, DUM_{89.12} - \underset{(-2.79)}{.264} \, DUM_{77.2} + \underset{(2.12)}{.0028} \ln (DGBAD) + \underset{(1.30)}{.020} \ln (DBBAD) - \underset{(-2.53)}{.00008} \, TREND^2$$

R^2 = .61; DW = 2.04

Retail Fluid Milk Supply:

$$\ln Q^{rfs} = \underset{(4.16)}{1.266} + \underset{(3.45)}{.793} \ln (P^{rf}/P^{wf}) - \underset{(-4.21)}{.057} \ln (P^{fe}/P^{wf}) + \underset{(5.06)}{.0284} \ln TREND + \underset{(2.37)}{.009} \, SIN1$$

$$+ \underset{(6.62)}{.0385} \, COS1 + \underset{(3.15)}{.392} \ln (Q^{rfs})_{-1} + \underset{(.58)}{.070} \ln (Q^{rfs})_{-4}$$

R^2 = .96; DW = 1.93

Retail Frozen Products Supply:

$$\ln Q^{rfzs} = \underset{(77.03)}{1.100} + \underset{(1.14)}{.323} \ln (P^{rfz}/P^{wfz}) - \underset{(-1.23)}{.056} \ln (P^{fe}/P^{wfz}) - \underset{(-13.43)}{.149} \, SIN1 - \underset{(-13.97)}{.155} \, COS1$$

$$+ \underset{(2.12)}{.289} \, (U^{rfzs})_{-1}$$

R^2 = .87; DW = 1.59

Retail Cheese Supply:

$$\ln Q^{rcs} = -\underset{(-1.09)}{.640} + \underset{(1.41)}{.322} \ln (P^{rc}/P^{wc}) - \underset{(-.48)}{.086} \ln (P^{lab}/P^{wc}) + \underset{(1.10)}{.012} \, SIN1 + \underset{(.93)}{.010} \, COS1$$

$$+ \underset{(3.57)}{.258} \ln (Q^{rcs})_{-1} + \underset{(7.15)}{.473} \ln (Q^{rcs})_{-4} + \underset{(5.47)}{.306} \, DUM_{82.2} - \underset{(-8.08)}{.460} \, DUM_{83.1}$$

R^2 = .87; DW = 2.12

Retail Butter Supply:

$$\ln Q^{rbs} = -\underset{(-1.20)}{2.998} + \underset{(1.51)}{1.255} \ln (P^{rb}/P^{wb}) - \underset{(-1.13)}{.558} \ln (P^{lab}/P^{wb}) - \underset{(-1.00)}{.079} \ln (P^{fe}/P^{wb})$$

$$+ \underset{(2.47)}{.052} \, COS1 + \underset{(2.76)}{.033} \, COS2 + \underset{(3.20)}{.332} \ln (Q^{rbs})_{-1} - \underset{(-3.95)}{.371} \, DUM_{80.2} - \underset{(-4.14)}{.389} \, DUM_{89.2}$$

R^2 = .64; DW = 1.88

Table 1. (Continued).

Wholesale Market

Wholesale Fluid Milk Supply:

$$\ln Q^{wfs} = \underset{(2.13)}{.283} + \underset{(4.29)}{.157} \ln (P^{wf}/(P^{II}+d)) - \underset{(-1.40)}{.014} \ln (P^{fe}/P(P^{II}+d)) - \underset{(-.31)}{.001} \ln TREND$$

$$+ \underset{(7.28)}{.038} COS1 + \underset{(2.28)}{.003} COS2 + \underset{(6.17)}{.580} \ln (Q^{wfs})_{-1} + \underset{(1.97)}{.201} \ln (Q^{wfs})_{-4}$$

R^2 = .96; DW = 2.35

Wholesale Frozen Supply:

$$\ln Q^{wfzs} = \underset{(2.90)}{.278} + \underset{(.72)}{.053} \ln (P^{wfz}/P^{II}) - \underset{(-2.84)}{060} SIN1 - \underset{(-5.18)}{.158} COS1 - \underset{(-4.31)}{.024} COS2$$

$$+ \underset{(2.30)}{.291} \ln (Q^{wfzs})_{-1} + \underset{(1.46)}{.267} \ln (Q^{wfzs})_{-4} + \underset{(2.99)}{.032} \ln TREND$$

R^2 = .97; DW = 2.23

Wholesale Cheese Supply:

$$\ln Q^{wcs} = \underset{(.49)}{.362} + \underset{(.36)}{.126} \ln (P^{wc}/P^{II}) + \underset{(4.68)}{.042} SIN1 - \underset{(-5.21)}{.037} COS1 + \underset{(5.59)}{.030} COS2 + \underset{(7.71)}{.661} \ln (Q^{wcs})_{-1}$$

$$+ \underset{(3.85)}{.313} \ln (Q^{wcs})_{-4} - \underset{(-1.78)}{.026} DTP - \underset{(-3.72)}{.060} MDP$$

R^2 = .95; DW = 1.41

Wholesale Butter Supply:

$$\ln Q^{wbs} = \underset{(3.11)}{1.211} + \underset{(1.65)}{.207} \ln (P^{wb}/P^{II}) + \underset{(15.19)}{.222} SIN1 + \underset{(1.39)}{.037} COS1 + \underset{(4.23)}{.509} \ln (Q^{wbs})_{-1}$$

$$+ \underset{(3.42)}{.004} TREND - \underset{(-1.96)}{.075} DTP - \underset{(-1.471)}{.052} MDP$$

R^2 = .86; DW = 1.99

Table 1. (Continued).

Farm Raw Milk Supply

Cow Numbers:

$$\ln COW = .244 + 1.600 \ln COW_{-1} - .929 \ln COW_{-2} + .306 \ln COW_{-3} + .012 \ln (P^{fm}/P^{feed})$$
(2.64) (13.73) (-4.91) (3.08) (1.81)

$$- .004 \ln (P^{cow}/P^{fr}) - .009 DTP$$
(-1.27) (-4.33)

$R^2 = .99$; DW = 1.91

Production Per Cow:

$$\ln PPC = 4.652 + .412 \ln PPC_{-1} + .031 \ln (P^{fm}/P^{feed}) + .003 FTREND + .019 SIN1$$
(5.80) (4.01) (1.34) (5.68) (2.80)

$$- .062 COS1 + .011 COS2 - .020 MDP$$
(-20.23) (4.97) (-2.34)

$R^2 = .98$; DW = 1.77

Table 2. Variable Definitions for the Econometric Model.

Endogenous Variables:

Q^{rfd} = retail fluid milk demand measured in bil. lbs. of milkfat equivalent,
P^{rf} = Consumer retail price index for fresh milk and cream (1982-84 = 100),
Q^{rfzd} = retail frozen dairy product demand measured in bil. lbs. of milkfat equivalent,
P^{rfz} = Consumer retail price index for frozen dairy products (1982-84 = 100),
Q^{rcd} = retail cheese demand measured in bil. lbs. of milkfat equivalent,
P^{rc} = Consumer retail price index for cheese (1982-84 = 100),
Q^{rbd} = retail butter demand measured in bil. lbs. of milkfat equivalent,
P^{rb} = Consumer retail price index for butter (1982-84 = 100),
Q^{rfs} = retail fluid milk supply measured in bil. lbs. of milkfat equivalent,
($Q^{rfs} = Q^{rfd}$),
P^{wf} = wholesale fluid milk price index (1982 = 100),
Q^{rfzs} = retail frozen dairy product supply measured in bil. lbs. of milkfat equivalent, ($Q^{rfzs} = Q^{rfzd}$),
P^{wfz} = wholesale frozen dairy products price index (1982 = 100),
Q^{rcs} = retail cheese supply measured in bil. lbs. of milkfat equivalent,
($Q^{rcs} = Q^{rcd}$),
P^{wc} = wholesale cheese price measured in cents/lb.,
Q^{rbs} = retail butter supply measured in bil. lbs. of milkfat equivalent,
($Q^{rbs} = Q^{rbd}$),
P^{wb} = wholesale butter price measured in cents/lb.,
Q^{wfs} = wholesale fluid milk supply measured in bil. lbs. of milkfat equivalent,
($Q^{wfs} = Q^{rfs} = Q^{rfd}$),
P^{II} = Class II price for raw milk measured in $/cwt.,
Q^{wfzs} = wholesale frozen dairy product supply measured in bil. lbs. of milkfat equivalent,
($Q^{wfzs} = Q^{rfzs} = Q^{rfzd}$),
Q^{wcs} = wholesale cheese supply measured in bil. lbs. of milkfat equivalent,
($Q^{wcs} = Q^{rcs} = Q^{rcd}$),
COW = U.S. cow numbers measured in thousands,
P^{fm} = U.S. average all milk price measured in $/cwt.,
PPC = U.S. average milk production per cow measured in lbs.,

Table 2. (Continued).

Exogenous Variables and Other Definitions:

POP = U.S. population measured in millions,

P^{bev} = Consumer retail price index for nonalcoholic beverages (1982-84 = 100),

INC = disposable personal income per capita, measured in thousand $,

CPI = Consumer price index for all items (1982-84 = 100),

TREND = time trend variable for the retail and wholesale-level equations, equal to 1 for 1975.1,...,

SIN1 = harmonic seasonal variable representing the first wave of the sine function,

COS1 = harmonic seasonal variable representing the first wave of the cosine function,

DGFAD = generic fluid milk advertising expenditures deflated by the media price index, measured in thousand $,

P^{foo} = Consumer retail price index for food (1982-84 = 100),

DBFZAD = brand frozen advertising expenditures deflated by the media price index, measured in thousand $,

L = lag operator,

P^{mea} = Consumer retail price index for meat (1982-84 = 100),

$DUM_{82.2}$ = intercept dummy variable equal to 1 for 1982.2, equal to 0 otherwise,

$DUM_{83.1}$ = intercept dummy variable equal to 1 for 1983.1, equal to 0 otherwise,

DGCAD = generic cheese advertising expenditures deflated by the media price index, measured in thousand $,

DBCAD = brand cheese advertising expenditures deflated by the media price index, measured in thousand $,

COS2 = harmonic seasonal variable representing the second wave of the cosine function,

$DUM_{80.2}$ = intercept dummy variable equal to 1 for 1980.2, equal to 0 otherwise,

$DUM_{89.2}$ = intercept dummy variable equal to 1 for 1989.2, equal to 0 otherwise,

DGBAD = generic butter advertising expenditures deflated by the media price index, measured in thousand $,

DBBAD = brand butter advertising expenditures deflated by the media price index, measured in thousand $,

P^{fe} = Producer price index for fuel and energy (1967 = 100),

U^{rfzs} = error term for retail frozen supply,

Table 2. (Continued).

P^{lab} = average hourly wage in food manufacturing sector ($/hour),
d = Class I fixed price differential for raw milk measured in $/cwt.,
DTP = intercept dummy variable for the Dairy Termination Program equal to 1 for 1986.2 through 1987.3; equal to 0 otherwise,
MDP = intercept dummy variable for the Milk Diversion Program equal to 1 for 1984.1 through 1985.2; equal to 0 otherwise,
Q^{wbs} = wholesale butter supply measured in bil. lbs. of milkfat equivalent,
($Q^{wbs} = Q^{rbs} = Q^{rbd}$),
P^{feed} = U.S. average price per ton of 16% protein dairy feed,
P^{fr} = U.S. index of prices received by farmers;
P^{COW} = U.S. average slaughter cow price measured in $/cwt.,
FTREND = time trend variable for the farm-level equations, equal to 1 for 1970.1,...,

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imposed. In the retail frozen products demand function, a second-order polynomial distributed lag model with both endpoint restrictions imposed is used for brand advertising. Generic advertising expenditures for frozen products are omitted from this equation for two reasons. First, there is no generic frozen product advertising for most of the time period in question. Second, the current level of generic frozen product advertising is quite minor. In the retail cheese demand function, a second-order polynomial distributed lag model with both endpoint restrictions imposed is used for both generic and brand advertising. Two intercept dummy variables, to capture outliers for quarter 2 of 1982 and quarter 1 of 1983, are also included in the retail cheese demand function. Retail cheese demand for these two quarters is well out of the range of all other observations. An intercept dummy variable for the 1986 Dairy Termination Program is also included in the retail cheese demand function. Current generic and brand advertising expenditures in the retail butter demand equation yield a better statistical fit than the model with lag structures. In addition, three intercept dummy variables are included in the retail butter demand function to account for three outliers: quarter 2 of 1977, quarter 2 of

1980, and quarters 1 and 2 of 1989. Retail butter demand for these quarters is well out of the range of all other observations.

Based on the estimation, brand cheese advertising has the largest coefficients of all advertising.[6] The sum of the current and lagged coefficients for brand cheese advertising is .093. This is followed by brand frozen products and brand butter advertising, where the sum of the current and lagged coefficients on brand frozen product advertising is .021 and the brand butter advertising coefficient is 0.020. The brand fluid milk advertising coefficient is small and statistically insignificant. Generic fluid milk advertising has the largest generic advertising coefficient, where the sum of current and lagged coefficients total 0.012. The generic butter advertising coefficient is 0.003. The sum of current and past generic cheese advertising coefficients is 0.007, but is statistically insignificant.

The retail supply for each product is estimated as a function of the retail price; the wholesale price, which represents the major variable cost to retailers; the producer price index for fuel and energy; the average hourly wage in the food manufacturing sector; a time trend variable; seasonal harmonic variables; and lagged retail supply. The producer price index for fuel and energy is used as a proxy for variable energy costs, while the average hourly wage is used to capture labor costs in the retail supply functions. The seasonal harmonic variables are included to capture seasonality in retail supply, while the lagged supply variables are incorporated to represent capacity constraints. The time trend variable is included as a proxy for technological change in retailing. Not all of these variables remain in each of the final estimated retail supply equations. In addition, intercept dummy variables appear in the cheese and butter retail supply equations to account for outliers in these two markets. Finally, a first-order moving average error structure is imposed on the retail frozen product supply equation.

The wholesale supply for each product is estimated as a function of the wholesale price; the appropriate Class price for milk (Class II or Class I = Class II + d, where d is the fixed

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[6]These coefficients are partial advertising elasticities from the structural retail demand equations. They are not the total elasticities from the reduced-form price equations.

fluid differential), which represents the main variable cost to wholesalers; the producer price index for fuel and energy; a time trend variable; seasonal harmonic variables; and lagged wholesale supply. The producer price index for fuel and energy is included because energy costs are important variable costs to wholesalers, and the seasonal harmonic variables are used to capture seasonality in wholesale supply. Lagged wholesale supply is included to reflect capacity constraints, and the trend variable is incorporated as a measure of technological change in dairy product processing.

For the farm milk market, the cow number equation is estimated as a function of the number of cows in previous periods, a one-period lagged ratio of the farm milk price to the price of 16% protein feed, the ratio of the price of slaughter cows to the index of prices received by farmers, and an intercept dummy variable to account for the quarters that the 1986-87 Dairy Termination Program was in effect. Lagged cow numbers are included as biological capacity constraints to current cow numbers, while the feed price represents one of the most important variable costs in milk production. The price of slaughter cows deflated by the index of prices received is included because it represents an opportunity cost of retaining cows.

The production per cow equation is estimated as a function of production per cow in the previous period, the ratio of the farm milk price to the price of 16% protein feed, a time trend variable, seasonal harmonic variables to account for seasonality in production per cow, and an intercept dummy variable to account for the quarters when the 1984-85 Milk Diversion Program was in effect. Lagged production per cow is included as a capacity constraint, the feed price is included because it represents one of the most important variable costs, and the time trend is included to capture genetic improvements over time. Note that the milk-feed price ratio is not lagged in the production per cow equation because some changes in production per cow can be made instantaneously, while changes in cow numbers can not.

In terms of statistical fit, most of the estimated equations are reasonable with respect to R^2 and the signs on all coefficients are as expected. In all but two equations, the adjusted coefficient of determination is above .77, and all but three are above .86. The two equations that are the most difficult to estimate are the retail butter demand and supply equations. The retail butter demand equation has the lowest R^2 (.61), and the retail butter supply equation has an R^2 of .64. On the whole, the equations are deemed reasonable for the simulation model.

Validation of the Simulation Model

To validate the model, a dynamic in-sample simulation is performed from the third quarter of 1984 (i.e., 1984.3) through the fourth quarter of 1990 (i.e., 1990.4). This period was chosen because it corresponds to the time in which the national generic advertising program was in operation. The results should be judged in terms of how close the predicted endogenous variables are to their historic values. The dynamic simulation is conducted as follows. First, all exogenous variables are set equal to their historic levels for the simulation period. Second, all lagged dependent variables and the predetermined farm milk supply for the first simulation period (1983.4) are set equal to their actual levels for the previous period (1983.3) and the retail-wholesale system of equations [product specific versions of equations (1.1) through (4.2), as well as (5.5)] is solved simultaneously using the Newton method. Third, predicted values for wholesale quantities and the Class II price are substituted into the farm milk price equation [equation (5.4)] to obtain the farm milk price. Fourth, the current period predicted farm milk price is substituted into the cow number and production per cow equations to obtain the farm milk supply for the subsequent period. Finally, the predicted endogenous variables become the lagged endogenous variables for the subsequent period, and the predetermined farm milk supply becomes the milk supply for the second period of the simulation. This process is repeated until the last period of the simulation (1990.4) is reached.

To measure how close each predicted endogenous variable is to its actual historical level, the root-mean-square-percent-simulation error (RMSPSE) measure is computed, which is equal to the following formula:

$$RMSPSE = \{(1/n) \sum_{t=1}^{n} ((YS_t - YA_t)/YA_t))^2\}^{1/2},$$

where: YS_t is the simulated value of endogenous variable Y, YA_t is the actual historic value for endogenous variable Y, and n is the number of periods in the simulation.

Table 3 shows the RMSPSE for all of the endogenous variables in the model. Generally, the RMSPSEs for the supply and demand quantities are quite reasonable. With the exception of retail butter demand, all retail, wholesale, and farm supply and demand quantities have RMSPSEs under 10%. However, retail butter demand has a RMSPSE of 19.3%. Recall that the retail butter market equation had the poorest statistical fit of all equations in the model. Consequently, it is not surprising that retail butter demand has a high RMSPSE. With respect to prices, the RMSPSEs tend to be higher, ranging from a low of 6.2% for the retail frozen products price to a high of 23.8% for the all milk price. There are several outliers in the dynamic simulation that are causing these relatively high RMSPSEs. In other words, with the exception of these outliers, the simulated prices actually track the actual prices better than the RMSPSE indicate. Finally, the RMSPSE for CCC purchases is 20.5%. While this may appear high, it is due to the small magnitude of this variable, i.e., a small deviation from the actual value leads to a large RMSPSE. Because the simulation model is to be used for comparing the differences between various advertising scenarios rather than for prediction, the model is deemed reasonable for this purpose.

Analysis of Advertising Scenarios

The equilibrium values for the price and quantity variables are simulated from the 1984.3 to 1990.4 for two sets of generic advertising scenarios. The first set of scenarios varies total generic advertising expenditures, while proportions allocated among products are held constant. The second set of scenarios holds constant total generic advertising expenditures and

Table 3. Quarterly Average (1984.3 Through 1990.4) of the Historic and Predicted Endogenous Variables from the Dynamic Simulation and the Root Mean Square Percent Simulation Error (RMSPE).

Variable	Unit	Actual Average	Simulated Average	RMSPE
Fluid milk demand	bil lbs	13.4	13.4	0.8%
Frozen demand	bil lbs	3.3	3.3	2.8%
Cheese demand	bil lbs	9.4	9.4	5.0%
Cheese supply	bil lbs	9.9	9.8	4.4%
Butter demand	bil lbs	4.9	5.6	19.3%
Butter supply	bil lbs	6.6	6.8	7.8%
Retail fluid milk price	82-84=100	108.6	108.9	12.9%
Retail frozen price	82-84=100	117.5	123.2	6.2%
Retail cheese price	82-84=100	111.1	113.0	10.2%
Retail butter price	82-84=100	101.8	117.8	18.2%
Wholesale fluid price	1982=100	108.5	109.1	14.3%
Wholesale frozen price	1982=100	112.0	106.3	9.5%
Wholesale cheese price	$/lb	1.30	1.37	17.3%
Wholesale butter price	$/lb	1.33	1.48	21.3%
Class II price	$/cwt	11.67	12.19	23.7%
Farm supply	bil lbs	35.8	38.6	9.7%
All milk price	$/cwt	12.85	13.19	23.8%
CCC cheese	bil lbs	0.5	0.4	NA
CCC butter	bil lbs	1.6	1.3	27.3%
CCC all	bil lbs	2.2	1.7	20.5%
Cow numbers	1,000s	10472	11408	10.8%
Production per cow	number	3428	3382	2.7%

varies the proportions allocated among fluid milk, cheese, and butter advertising. The results for each set of scenarios are summarized below.

Alternative Generic Advertising Expenditure Levels

In the first set of advertising scenarios, total generic advertising expenditures are varied from 5% to 200% of historical levels in 50% increments. It is assumed that the proportion of revenue allocated among fluid milk, cheese, butter, and frozen products is the same as its actual quarterly percentages were from 1984.3 through 1990.4. The results of these scenarios are reported in Table 4, which gives quarterly averages[7] for all endogenous variables for generic expenditures based on 5%, 50%, 100% (baseline), 150%, and 200% of historical levels. Table 5 gives the results in terms of percentage change from the baseline for the endogenous variables under the various expenditure scenarios.

The level of generic promotion appears to have an effect on all levels of the dairy industry. For example, at the retail level, commercial demand for milk and dairy products on a milk equivalent basis ranges from 30.8 billion pounds under the 5% of historical generic advertising to 31.9 billion pounds under two times historical advertising expenditures, an increase of 3.6%. It is interesting to note that the entire increase in consumption from higher generic advertising is due to increases in fluid milk consumption. In fact, consumption of frozen products, cheese, and butter are marginally lower under the higher generic advertising scenarios. This is due to the fact that higher generic advertising levels also raise retail prices for dairy products. For instance, the average retail price for frozen products, cheese, and butter under the 200% generic advertising scenario are 3.3%, 11.3%, and 4.6% higher, respectively, than they are under the 5% scenario. Hence, it appears that the increase in these retail prices has a slightly larger negative effect on consumption of these products than does the positive effect due to higher generic advertising. While the retail fluid milk price also increases (by 35%), fluid milk consumption is still larger under higher generic advertising because its price elasticity of demand is very inelastic compared to the other dairy products.

The wholesale market is also impacted by the level of generic advertising. As was the case in the retail market, the wholesale fluid milk price is most effected by alternative generic advertising expenditures. The wholesale fluid milk price index increases by 30.3% as generic

[7]The quarterly average for all endogenous variables is based on a simple average for the time period 1984.3 through 1990.4.

Table 4. Quarterly Average Values (1984.3 Through 1990.4) of Endogenous Variables When Generic Advertising Expenditures are Varied from 5% to 200% of Actual Levels.

Variable	Unit	5%	50%	Baseline	150%	200%
Fluid milk demand	bil lbs	12.5	13.2	13.4	13.5	13.5
Frozen product demand	bil lbs	3.3	3.3	3.3	3.3	3.2
Cheese demand	bil lbs	9.4	9.4	9.4	9.4	9.4
Cheese supply	bil lbs	10.5	9.9	9.8	9.8	9.7
Butter demand	bil lbs	5.7	5.6	5.6	5.6	5.6
Butter supply	bil lbs	6.9	6.8	6.8	6.7	6.7
Retail fluid price	82-84=100	86.94	102.50	108.85	113.30	117.28
Retail frozen price	82-84=100	120.56	122.32	123.21	123.91	124.60
Retail cheese price	82-84=100	105.06	110.33	113.00	115.05	117.03
Retail butter price	82-84=100	114.05	116.68	117.77	118.51	119.28
Wholesale fluid price	1982=100	89.79	103.35	109.10	113.23	117.05
Wholesale frozen price	1982=100	101.07	104.50	106.29	107.73	109.09
Wholesale cheese price	$/lb	1.22	1.31	1.37	1.41	1.45
Wholesale butter price	$/lb	1.37	1.44	1.48	1.50	1.52
Class II price	$/cwt	10.74	11.68	12.19	12.59	12.99
Farm supply	bil lbs	37.8	38.3	38.6	38.8	39.0
All milk price	$/cwt	11.68	12.67	13.19	13.60	14.01
CCC cheese	bil lbs	1.0	0.5	0.4	0.4	0.4
CCC butter	bil lbs	1.3	1.3	1.3	1.3	1.4
CCC all	bil lbs	2.3	1.8	1.7	1.7	1.7
Cow numbers	1,000s	11236	11348	11408	11456	11493
Production per cow	number	3364	3376	3382	3387	3392
Producer surplus	bil $	2.51	2.76	2.89	3.00	3.11
Farm rate of return[1]	%	NA	9.8	4.6	3.7	3.5

[1]Farm rate of return is equal to the change in producer surplus divided by the respective change in advertising expenditures.

Table 5. Percentage Change in Endogenous Variables from Baseline When Generic Advertising Expenditures are Varied from 5% to 200% of Actual Levels.

Variable	Unit	Baseline	5%	50%	150%	200%
			------ -------Percent	Change from Baseline -----		
Fluid milk demand	bil lbs	13.4	-6.1	-1.4	0.8	1.4
Frozen product demand	bil lbs	3.3	0.8	0.3	-0.2	-0.4
Cheese demand	bil lbs	9.4	-0.2	0.1	-0.2	-0.4
Cheese supply	bil lbs	9.8	6.6	1.3	-0.5	-0.7
Butter demand	bil lbs	5.6	0.5	0.2	-0.1	-0.4
Butter supply	bil lbs	6.8	2.1	0.8	-0.7	-1.5
Retail fluid milk price	82-84=100	108.85	-20.1	-5.8	4.1	7.7
Retail frozen price	82-84=100	123.21	-2.1	-0.7	0.6	1.1
Retail cheese price	82-84=100	113.00	-7.0	-2.4	1.8	3.6
Retail butter price	82-84=100	117.77	-3.2	-0.9	0.6	1.3
Wholesale fluid price	1982=100	109.10	-17.7	-5.3	3.8	7.3
Wholesale frozen price	1982=100	106.29	-4.9	-1.7	1.4	2.6
Wholesale cheese price	$/lb	1.37	-10.7	-3.9	3.0	6.5
Wholesale butter price	$/lb	1.48	-7.2	-2.2	1.6	3.2
Class II price	$/cwt	12.19	-11.8	-4.1	3.3	6.6
Farm supply	bil lbs	38.6	-2.1	-0.7	0.6	1.1
All milk price	$/cwt	13.19	-11.4	-3.9	3.1	6.2
CCC cheese	bil lbs	0.4	165.5	20.4	-2.7	-6.5
CCC butter	bil lbs	1.3	-4.3	0.1	-0.2	4.8
CCC all	bil lbs	1.7	34.6	4.8	-0.8	2.2
Cow numbers	1,000s	11408	-1.5	-0.5	0.4	0.7
Production per cow	number	3382	-0.5	-0.2	0.1	0.3
Producer surplus	bil $	2.89	-13.2	-4.5	3.8	

advertising is increased from 5% to 200% of historical levels (Tables 4 and 5). The wholesale cheese, butter, and frozen product prices are also impacted, rising by 18.9%, 11%, and 7.9%, respectively, when generic advertising is increased from 5% to 200% of historical expenditures.

Generic advertising has a negative effect on government purchases under the dairy price support program. For example, net CCC purchases of dairy products decline from an average of 2.3 billion pounds per quarter under the 5% generic advertising case, to 1.7 billion pounds in the 200% scenario (see Table 4). The results indicate that the national dairy promotion program can lower government removals of surplus dairy products from the market. However, the results also suggest that there are diminishing marginal returns of lowering CCC purchases as generic advertising increases. As Tables 4 and 5 show, there is a substantial decline in CCC purchases as generic advertising is increased from 5% to 50% of historical levels. However, any increases in generic advertising above historical levels result in no decrease in CCC purchases.

Generic advertising also impacts the farm sector. On the price side, the farm milk price increases from an average of $11.68 per hundredweight under the 5% generic advertising scenario to an average of $14.01 per hundredweight under the 200% scenario, which is an increase of almost 20%. Because the farm milk price is larger under higher generic advertising, so too is the farm milk supply. The farm supply of raw milk increases from 37.8 billion pounds per quarter in the 5% scenario to 39 billion pounds per quarter in the 200% scenario, an increase of 3.2%. This increase in the farm milk supply with higher advertising is one of the reasons why CCC purchases do not decrease when advertising is increased above historical levels. The results indicate that farmers benefit from higher generic advertising levels. As shown in Table 4, producer surplus[8] increases from $2.51 billion in the 5%

[8]Producer surplus is calculated using the production per cow and cow number equations. More generally, these two equations can be written as:

$$\ln PPC = \alpha_0 + \alpha_1 \ln P^{fm}$$
$$\ln COW = \beta_0 + \beta_1 \ln P^{fm},$$

scenario to \$3.1 billion in the 200% scenario. However, the rate of increase diminishes as generic advertising levels are increased.

One measure of the net marginal benefits of generic advertising to farmers is the rate of return at the margin, which gives the ratio of marginal benefits to marginal costs of generic advertising. Specifically, this rate of return measure is calculated as the change in producer surplus, due to an incremental increase in generic advertising, divided by the change in advertising costs. The current results show that the rate of return from current generic advertising levels is 4.6. That means every dollar invested in generic advertising returns \$4.60 in producer surplus to farmers. Not surprisingly, this rate of return declines as generic advertising is increased. This farm-level rate of return is quite close to a comparable estimate of 4.77 by Liu et al. (1990) for the period 1975.1 through 1987.4.

It should be noted that the farther the simulation scenario is from actual observations, the less reliable the model becomes. This is due to the fact that all equations in the model are estimated based on actual observations. Consequently, some caution should be made in literally interpreting the results from the more extreme scenarios such as the 5% and 200% generic advertising scenarios.

Alternative Allocations of Generic Advertising Across Products

In the second set of advertising scenarios, the proportion of generic advertising expenditures allocated among fluid milk, cheese, and butter is varied, while total generic expenditures are held constant at historical levels. Four scenarios are specified. In the first scenario (baseline), the proportions are set according to their 1991 levels from the National

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where α_0 and β_0 are time varying intercepts, and they represent the effect on the dependent variable of all explannatory variables other than milk price, and α_1 and β_1 are price elasticities. Multiplying these two equations and performing suitable transformations to make price and quantity units consistent yields the following supply curve, which is used to calculate producer surplus from:

$$\ln Q^{fm} = \gamma_0 + \gamma_1 \ln P^{fm},$$

where γ_0 equals $(\alpha_0 + \beta_0)$ and γ_1 equals $(\alpha_1$ and $\beta_1)$.

Dairy Board budget: 49.3% for fluid milk, 36.3% for cheese, and 8.7% for butter. It should be noted that these percentages sum to only 94.3% because money spent on generic frozen product advertising (5.7%) is ignored in this analysis since it is not included as a variable in the retail frozen product demand function. The second scenario is the heavy generic fluid milk advertising case, which has 80% of total generic advertising for fluid milk, 14.3% for generic cheese, and 3.4% for butter. In the third scenario (heavy generic cheese advertising), the allocation of generic advertising favors cheese with 70% allocated to cheese, 23.2% to fluid milk, and 4.1% to butter. Finally, the fourth scenario (heavy generic butter advertising) more than doubles generic butter advertising from its historical levels with the following allocation: 20% for butter, 43.2% for fluid milk, and 31.8% for cheese. The results of these scenarios are reported in Table 6, which gives quarterly averages for all endogenous variables for the baseline, heavy fluid milk, heavy cheese, and heavy butter advertising scenarios. Table 7 provides the percentage change in endogenous variables from the baseline for the three re-allocation scenarios.

It is clear from Tables 6 and 7 that of all scenarios the heavy generic fluid milk advertising scenario has the largest effect on the dairy industry. At the retail level, this scenario causes fluid milk demand to increase by 1% compared to the current (baseline) situation. At the same time, however, frozen product, cheese, and butter demand declines under this scenario by 2%, 0.8%, and 1.7%, respectively. The decline in dairy product demand is due to the result that the heavy generic fluid milk advertising strategy not only raises the retail fluid milk price, but also the retail frozen product, cheese, and butter prices. Retail prices for fluid milk, frozen products, cheese, and butter increase by 4.3%, 0.5%, 0.9%, and 0.2%, respectively, compared with the baseline. The wholesale prices for all products also increase relative to the current situation with the wholesale fluid milk price increasing by 3.9%, the wholesale frozen product price by 1.2%, the wholesale cheese price by 3%, and the wholesale butter price by 0.9%. Net government purchases under the dairy price support program are unchanged by the heavy generic fluid milk advertising scenario compared with the

Table 6. Quarterly Average Values (1984.3 Through 1990.4) of Endogenous Variables for Alternative Advertising Expenditure Scenarios Between Fluid Milk, Cheese, and Butter.

Variable	Unit	Baseline	Heavy Fluid Milk	Heavy Cheese	Heavy Butter
Fluid milk demand	bil lbs	13.4	13.6	13.2	13.4
Frozen product demand	bil lbs	3.3	3.2	3.3	3.3
Cheese demand	bil lbs	9.4	9.4	9.5	9.5
Cheese supply	bil lbs	9.8	9.7	10.0	9.8
Butter demand	bil lbs	5.6	5.5	5.6	5.6
Butter supply	bil lbs	6.7	6.6	6.8	6.7
Retail fluid milk price	82-84=100	112.0	116.8	105.2	110.7
Retail frozen price	82-84=100	124.8	125.4	123.9	124.6
Retail cheese price	82-84=100	115.2	116.2	113.4	114.6
Retail butter price	82-84=100	117.2	117.4	116.2	117.2
Wholesale fluid price	1982=100	112.1	116.5	106.0	110.9
Wholesale frozen price	1982=100	108.2	109.5	106.4	107.9
Wholesale cheese price	$/lb	1.40	1.44	1.35	1.39
Wholesale butter price	$/lb	1.48	1.49	1.45	1.48
Class II price	$/cwt	12.51	12.88	12.01	12.41
Farm supply	bil lbs	38.8	39.0	38.5	38.7
All milk price	$/cwt	13.52	13.90	13.00	13.41
CCC cheese	bil lbs	0.4	0.4	0.4	0.4
CCC butter	bil lbs	1.3	1.3	1.3	1.3
CCC all	bil lbs	1.7	1.7	1.8	1.7
Cow numbers	1,000s	11445	11482	11383	11433
Production per cow	number	3386	3391	3380	3385
Producer surplus	bil $	2.98	3.08	2.85	2.96

baseline. This scenario has the largest impact on the farm milk price, which increases by 2.8% above the baseline. Accompanying this increase in price is a small increase of 0.5% in milk supply. Farmers are best off under this scenario as producer surplus increases by 3.4% from the current allocation.

In terms of the heavy generic cheese advertising scenario, it is interesting that average cheese demand only increases modestly (0.8%) from the baseline level (see Tables 6 and 7). Fluid milk demand declines by 1.5% because of the accompanying decrease in generic fluid

Table 7. Percentage Change from Baseline of Endogenous Variables for Alternative Advertising Expenditure Scenarios Among Products.

Variable	Unit	Baseline	Heavy Fluid	Heavy Cheese	Heavy Butter
Fluid demand	bil lbs	13.4	1.0	-1.5	-0.3
Frozen demand	bil lbs	3.3	-0.2	0.2	0.0
Cheese demand	bil lbs	9.5	-0.8	0.8	0.0
Cheese supply	bil lbs	9.8	-0.7	1.4	0.2
Butter demand	bil lbs	5.6	-0.3	0.1	0.2
Butter supply	bil lbs	6.7	-0.9	0.9	0.2
Retail fluid price	82-84=100	112.0	4.3	-6.0	-1.2
Retail frozen price	82-84=100	124.8	0.5	-0.7	-0.1
Retail cheese price	82-84=100	115.2	0.9	-1.5	-0.5
Retail butter price	82-84=100	117.2	0.2	-0.9	0.0
Wholesale fluid price	1982=100	112.1	3.9	-5.4	-1.0
Wholesale frozen price	1982=100	108.2	1.2	-1.7	-0.3
Wholesale cheese price	$/lb	1.40	3.0	-3.7	-0.8
Wholesale butter price	$/lb	1.48	0.9	-2.1	-0.2
Class II price	$/cwt	12.51	3.0	-4.0	-0.8
Farm supply	bil lbs	38.8	0.5	-0.7	-0.1
All milk price	$/cwt	13.52	2.8	-3.8	-0.8
CCC cheese	bil lbs	0.4	1.3	13.3	3.2
CCC butter	bil lbs	1.3	1.9	2.1	0.1
CCC all	bil lbs	1.7	1.8	4.6	0.8
Cow numbers	1,000s	11445	0.3	-0.5	-0.1
Production per cow	number	3386	0.1	-0.2	0.0
Producer surplus	bil $	2.98	3.4	-4.4	-0.7

milk advertising. Butter and frozen product demand increase marginally relative to the baseline. Retail and wholesale prices for all four products actually decline under the heavy generic cheese advertising scenario. This is due to the result that there is a slight decrease in total demand for milk and dairy products from the current situation. Government purchases of dairy products increase under this scenario, with cheese purchases by the CCC increasing as well. The seemingly unintuitive result is due to the fact that there is a larger increase in cheese supply than in cheese demand under this scenario. This result is due to the Class II price decreasing under this scenario, which causes the cheese supply to increase. The average farm milk price is lowest under this scenario, falling by 3.8% from the baseline. This decrease is caused by the decline in fluid milk demand, which causes Class I utilization to drop. Consequently, the share of the higher Class I price becomes smaller in determining the average farm milk price. Since producer surplus is the lowest in this scenario (4.4% lower than the baseline), the allocation of generic advertising in this case is the worst from the point of view of farmers.

The heavy generic butter advertising scenario has the least impact on market variables of all three alternatives to the baseline. Similar to the previous scenario, butter demand only increases marginally (0.2%) under the heavy generic butter advertising scenario (see Tables 6 and 7). Fluid milk, frozen product, and cheese demand are virtually unchanged under this scenario relative to the current situation. This is probably due to the fact that there is not as much re-allocation in this scenario among products as there is for the heavy fluid milk and heavy cheese advertising scenarios. Because of this, there is very little change in retail and wholesale prices. Retail fluid milk, frozen products, and cheese prices decrease by 1.2%, 0.1%, and 0.5%, respectively compared to the baseline. The retail butter price does not change. Wholesale fluid milk, frozen products, and cheese prices decrease by 1%, 0.3%, 0.8%, respectively compared to the baseline. There is a marginal decrease in the wholesale butter price. The reason that the retail and wholesale butter prices are not affected by the more than doubling of generic butter advertising is because there is little change in butter demand and supply, or in the Class II price in this scenario. Government purchases of dairy products under the dairy price support program remain the same in this scenario as the baseline. The farm milk price is only marginally lower (0.8%) than the baseline and the milk supply is virtually identical. Also, producer surplus is only slightly lower under this scenario (0.7%) compared with the baseline. Hence, it appears that this scenario has the smallest impact on the market relative to the current situation.

Summary

The purpose of this paper was to analyze the impacts of several generic dairy advertising scenarios on retail, wholesale, and farm dairy markets. A disaggregated industry model of the retail, wholesale and farm levels with markets for fluid milk, frozen products, cheese, and butter was developed to conduct the analysis. An econometric model of the dairy industry was estimated using quarterly data from 1975 through 1990 (1970 through 1990 for the farm-level equations). The econometric results were then used to simulate the market impacts of two sets of generic advertising scenarios on demand for milk and dairy products, farm and consumer prices, and producer welfare. In the first set of scenarios, total generic expenditure levels were varied from 5% to 200% of their historical values. The second set of scenarios held constant total generic advertising expenditures, but reallocated the revenue among fluid milk, cheese, and butter to determine which of the products have the largest consumption and price response to advertising.

The results of the first set of scenarios indicated that the level of generic advertising does have an impact on market prices and quantities. In terms of increasing demand, increases in total generic advertising had its largest impact on fluid milk. In fact, there were slight declines in the demand for the other dairy products as generic advertising was increased. Retail and wholesale level prices were found to increase with increases in generic advertising expenditures, with fluid milk prices rising the most. Increases in generic advertising resulted in decreases in government purchases of dairy products for advertising levels that were less than actual historical expenditures. However, CCC purchases did not decline for generic advertising levels above historical amounts. Finally, the results showed that farmers benefit from higher generic advertising levels in terms of higher milk prices and producer surplus. The farm rate of return at the margin for current generic advertising levels was estimated to be 4.6.

The results of the second set of scenarios indicated that the allocation of revenue among products also can have a major impact on market variables. For instance, in the heavy fluid milk advertising scenario (where generic fluid milk advertising is doubled at the expense of cheese and butter advertising) fluid milk demand increased by 1%, the retail fluid milk price increased by 4.3%, the wholesale fluid milk price increased by 3.9%, the wholesale cheese price increased by 3%, the Class II price increased by 3%, and the farm milk price increased by 2.8% relative to the current allocation. The heavy cheese advertising scenario (where generic cheese advertising is more than doubled at the expense of generic fluid milk and butter advertising) had almost the opposite effect as the heavy fluid milk advertising scenario. For instance, in the heavy cheese advertising case, fluid milk demand declined by 1.5%, the retail fluid milk price declined by 6%, the wholesale fluid milk price declined by 5.4%, the wholesale cheese price declined by 3.7%, the Class II price declined by 4%, and the farm milk price declined by 3.8% relative to the current situation. Finally, the results of the heavy butter advertising scenario indicated that this scenario is quite similar to the current situation, which was due to a lower degree of reallocation of generic advertising relative to the baseline under this scenario. The results also indicated that producer welfare was highest under the heavy fluid milk advertising scenario, lowest under the heavy cheese advertising case, and virtually identical to the baseline situation under the heavy butter advertising scenario.

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Appendix: The Data and Data Sources

The following tables lists all the data used in this study. The numbers in parentheses at the bottom of each series gives the source of the data. The sources are the following:

(1) Liu, D.J., H.M. Kaiser, O.D. Forker, and T.D. Mount. "The Economic Implications of the U.S. Generic Dairy Advertising Program: An Industry Model Approach." **A.E. Res. 89-22**, Department of Agricultural Economics, Cornell University, November 1989. The updated data from 1988 through 1990 used identical sources as this reference.

(2) Cox, T. "A Quarterly Database for the Analysis of the U.S. Dairy Sector, 1970-90." Department of Agricultural Economics, University of Wisconsin, May 1992.

(3) Computed as follows: demand equals supply minus change in commercial inventories minus government purchases.

(4) **Cold Storage Reports**, U.S. Department of Agriculture.

(5) **Dairy Products,** U.S. Department of Agriculture, and **Federal Milk Market Order Statistics**, U.S. Department of Agriculture, selected issues.

(6) **Dairy Situation and Outlook**, U.S. Department of Agriculture.

(7) **Dairy Situation and Outlook**, U.S. Department of Agriculture, for quarter 1 and quarter 3 data. Quarter 2 data computed as average of quarter 1 and 3, while quarter 4 data computed as average of quarter 3 and quarter 1 (in subsequent year) data.

(8) Computed as follows: Class I price differential equals Class I price minus Class II price.

(9) Leading National Advertisers.

	Production Per Cow (lbs)	Cow Numbers (1000)	Milk Production (bil lbs)	On-Farm Use (bil lbs)	Replace Heiffers (mil)	All Milk Price ($/cwt)	Slaughter Cow Price ($/cwt)	Slaughter Calf Price ($/cwt)	Cow Price ($/cwt)
I 1970	2,350	12,070	28.4	1.1	4000	5.74	20.97	35.03	320.33
II	2,668	12,017	32.1	1.0	3979	5.45	21.63	35.67	329.33
III	2,435	11,970	29.1	1.0	3957	5.62	20.17	34.13	337.00
IV	2,300	11,931	27.4	1.0	3936	6.06	18.97	33.30	340.67
I 1971	2,422	11,891	28.8	1.0	3915	5.94	20.23	34.90	347.33
II	2,735	11,851	32.4	1.0	3894	5.62	21.03	35.67	357.67
III	2,494	11,819	29.5	1.0	3873	5.79	20.87	35.93	361.67
IV	2,365	11,790	27.9	0.9	3852	6.15	20.83	37.70	367.00
I 1972	2,517	11,755	29.6	0.9	3828	6.09	22.90	40.90	379.67
II	2,801	11,718	32.8	0.9	3840	5.79	24.33	42.80	392.00
III	2,561	11,671	29.9	0.9	3851	6.00	25.13	45.23	402.67
IV	2,384	11,642	27.8	0.9	3863	6.48	25.03	46.83	414.00
I 1973	2,480	11,559	28.7	0.9	3874	6.57	29.73	53.63	442.67
II	2,780	11,439	31.8	0.8	3896	6.41	32.83	58.00	484.33
III	2,503	11,348	28.4	0.8	3918	7.21	35.43	62.87	522.67
IV	2,355	11,309	26.6	0.8	3930	8.59	30.87	53.53	533.33
I 1974	2,494	11,265	28.1	0.8	3942	8.92	32.30	52.33	543.67
II	2,815	11,227	31.6	0.8	3921	8.26	28.10	42.50	531.00
III	2,587	11,218	29.0	0.8	3900	7.82	23.07	33.47	493.33
IV	2,397	11,212	26.9	0.8	3994	8.37	17.67	26.13	431.00
I 1975	2,512	11,197	28.1	0.8	4087	8.34	17.77	24.40	395.33
II	2,808	11,162	31.3	0.8	4006	8.08	21.33	28.37	406.00
III	2,569	11,118	28.6	0.8	3924	8.71	20.13	26.67	413.67
IV	2,469	11,079	27.4	0.8	3941	10.00	19.90	28.30	434.67
I 1976	2,638	11,060	29.2	0.7	3958	9.87	24.63	33.13	466.00
II	2,934	11,031	32.4	0.7	3950	9.26	28.17	38.23	481.33
III	2,734	11,023	30.1	0.7	3942	9.66	24.60	34.00	477.67
IV	2,588	11,011	28.5	0.7	3915	9.86	21.50	32.63	483.00
I 1977	2,708	10,983	29.7	0.7	3888	9.54	24.33	35.23	485.67
II	3,019	10,951	33.1	0.7	3947	9.40	25.90	37.47	501.00
III	2,821	10,937	30.9	0.7	4005	9.71	24.13	37.17	508.00
IV	2,659	10,907	29.0	0.7	3946	10.17	23.33	37.17	519.33
I 1978	2,734	10,860	29.7	0.7	3886	10.20	29.83	45.30	556.33
II	3,021	10,784	32.6	0.7	3921	10.07	36.50	57.30	634.33
III	2,817	10,779	30.4	0.7	3955	10.50	36.97	62.57	704.00
IV	2,671	10,791	28.8	0.7	3944	11.57	40.07	68.57	802.67
I 1979	2,765	10,762	29.8	0.6	3932	11.87	51.03	86.97	917.00
II	3,061	10,710	32.8	0.6	4024	11.53	54.30	96.67	1046.67
III	2,898	10,719	31.1	0.6	4115	11.97	48.60	89.47	1086.67
IV	2,770	10,741	29.8	0.6	4137	12.77	47.10	85.83	1126.67
I 1980	2,902	10,752	31.2	0.6	4158	12.80	50.37	86.80	1176.67
II	3,160	10,771	34.0	0.6	4268	12.60	44.37	75.93	1190.00
III	2,977	10,811	32.2	0.6	4377	12.87	44.43	75.10	1186.67

	Production Per Cow (lbs)	Cow Numbers (1000)	Milk Production (bil lbs)	On-Farm Use (bil lbs)	Replace Heifers (mil)	All Milk Price ($/cwt)	Slaughter Cow Price ($/cwt)	Slaughter Calf Price ($/cwt)	Cow Price ($/cwt)
IV 1980	2,856	10,846	31.0	0.6	4361	13.93	43.47	72.10	1226.67
I 1981	2,992	10,851	32.5	0.6	4345	13.97	43.93	69.93	1230.00
II	3,235	10,871	35.2	0.6	4487	13.53	43.13	67.30	1203.33
III	3,034	10,906	33.1	0.6	4628	13.53	42.07	61.90	1200.00
IV	2,922	10,964	32.0	0.6	4588	14.00	36.83	58.70	1176.67
I 1982	3,017	10,995	33.2	0.6	4547	13.83	38.53	59.27	1150.00
II	3,239	10,985	35.6	0.6	4664	13.30	41.17	62.67	1110.00
III	3,082	11,007	33.9	0.6	4780	13.37	39.50	60.40	1110.00
IV	2,974	11,040	32.8	0.6	4663	13.87	35.57	58.40	1080.00
I 1983	3,090	11,058	34.2	0.6	4545	13.77	40.37	65.77	1050.00
II	3,321	11,089	36.8	0.6	4713	13.37	41.83	65.73	1060.00
III	3,144	11,112	34.9	0.6	4880	13.33	37.73	57.93	1060.00
IV	3,030	11,131	33.7	0.6	4706	13.83	34.00	59.07	960.00
I 1984	3,108	10,925	34.0	0.7	4532	13.40	38.83	62.90	870.00
II	3,296	10,799	35.6	0.7	4741	12.97	39.77	60.77	910.00
III	3,100	10,804	33.5	0.7	4950	13.20	36.67	58.27	910.00
IV	3,003	10,806	32.4	0.7	4855	14.10	34.43	59.00	890.00
I 1985	3,109	10,816	33.6	0.7	4770	13.63	39.30	65.13	875.00
II	3,403	10,987	37.4	0.6	4885	12.53	38.97	64.53	885.00
III	3,305	11,099	36.7	0.6	5000	12.17	34.90	59.90	865.00
IV	3,174	11,162	35.4	0.6	4855	12.60	32.97	60.13	815.00
I 1986	3,251	11,126	36.2	0.6	4709	12.37	35.90	61.57	800.00
II	3,305	10,943	36.2	0.6	4705	12.00	35.07	58.33	810.00
III	3,327	10,703	35.6	0.6	4700	12.37	35.80	61.30	835.00
IV	3,199	10,541	33.7	0.6	4503	13.33	35.20	62.37	840.00
I 1987	3,340	10,424	34.8	0.5	4305	12.97	41.00	69.83	855.00
II	3,617	10,339	37.4	0.6	4453	12.07	43.33	77.10	920.00
III	3,453	10,283	35.5	0.6	4600	12.30	44.20	82.83	935.00
IV	3,375	10,291	34.7	0.6	4361	12.87	43.60	82.43	955.00
I 1988	3,519	10,285	36.2	0.6	4122	12.20	48.00	91.43	970.00
II	3,697	10,244	37.9	0.6	4261	11.43	46.70	90.50	1020.00
III	3,526	10,218	36.0	0.6	4400	11.87	45.73	89.40	975.00
IV	3,471	10,208	35.4	0.6	4285	13.30	44.97	88.07	980.00
I 1989	3,611	10,149	36.6	0.5	4169	13.07	48.40	94.23	1000.00
II	3,763	10,110	38.0	0.5	4335	12.20	47.30	91.87	1040.00
III	3,484	10,101	35.2	0.5	4500	12.41	48.97	93.30	1030.00
IV	3,448	10,127	34.9	0.5	4364	14.50	47.77	87.97	1060.00
I 1990	3,627	10,128	36.7	0.5	4227	14.63	51.77	95.37	1120.00
II	3,820	10,111	38.6	0.5	4214	13.57	53.37	99.83	1140.00
III	3,620	10,119	36.6	0.5	4200	14.03	52.83	97.07	1160.00
IV	3,575	10,151	36.3	0.5	4197	12.50	49.13	94.50	1200.00
SOURCE	(1)	(1)	(1)	(2)	(7)	(1)	(1)	(1)	(1)

	16% Dairy Feed ($/ton)	All Hay Price ($/ton)	Wage Paid by Farmers (77=100)	Class II Price ($/cwt)	Class I Price ($/cwt)	Class I Differential ($/cwt)	Fluid Demand/ Supply ME Fat (bil lbs)	Cheese Supply ME Fat (bil lbs)	Butter Supply ME Fat (bil lbs)	Frozen Demand/ Supply ME Fat (bil lbs)
I 1970	74.00	25.00	55.0	4.63	6.73	2.10	13.2	4.6	6.3	2.3
II	73.00	24.10	57.0	4.60	6.67	2.07	12.7	5.6	7.2	3.1
III	74.33	22.10	56.0	4.62	6.70	2.07	12.5	4.8	5.1	3.3
IV	77.67	23.90	58.0	4.81	6.84	2.03	13.6	4.5	5.3	2.2
I 1971	80.33	24.40	58.0	4.81	6.91	2.10	13.1	4.9	6.5	2.3
II	80.00	26.10	60.0	4.79	6.91	2.12	12.5	6.0	7.2	3.0
III	78.33	24.10	59.0	4.79	6.86	2.07	12.5	5.2	5.0	3.3
IV	76.00	24.90	61.0	4.86	6.92	2.06	13.6	4.9	5.1	2.3
I 1972	77.67	29.20	60.0	4.99	7.04	2.04	13.6	5.5	6.3	2.4
II	77.33	28.00	64.0	4.95	7.09	2.14	13.0	6.5	6.9	3.0
III	79.33	28.50	63.0	5.06	7.06	2.00	12.9	5.7	4.7	3.3
IV	86.67	30.30	65.0	5.30	7.21	1.91	13.7	5.2	4.6	2.3
I 1973	100.33	34.60	65.0	5.48	7.48	2.01	13.6	5.5	5.5	2.4
II	105.00	33.90	70.0	5.67	7.64	1.97	12.9	6.8	5.6	3.1
III	118.67	36.30	69.0	6.36	7.96	1.60	12.5	5.6	3.5	3.3
IV	126.33	46.20	71.0	7.69	9.02	1.33	13.3	5.6	3.9	2.3
I 1974	133.33	47.10	78.0	8.13	9.99	1.86	12.7	6.6	4.6	2.4
II	125.33	44.40	77.0	6.99	10.11	3.12	12.2	7.3	5.8	3.1
III	142.00	48.20	79.0	6.46	8.60	2.15	12.4	6.1	4.3	3.4
IV	150.00	51.50	80.0	6.66	8.73	2.06	13.2	5.5	4.6	2.4
I 1975	138.33	50.10	84.0	6.84	8.90	2.07	13.0	5.6	5.8	2.5
II	132.00	52.40	84.0	7.02	8.99	1.96	12.6	6.7	5.9	3.4
III	133.33	51.20	85.0	7.77	9.25	1.47	12.6	5.9	3.7	3.6
IV	134.33	50.30	86.0	8.84	10.27	1.43	13.4	5.8	4.3	2.5
I 1976	136.00	52.70	94.0	8.58	11.03	2.45	13.2	6.6	5.3	2.6
II	138.33	54.10	92.0	8.35	10.53	2.18	12.5	8.1	5.2	3.1
III	145.67	59.00	94.0	8.72	10.54	1.82	12.5	7.3	4.0	3.5
IV	144.33	60.10	91.0	8.26	10.66	2.41	13.4	6.8	5.0	2.4
I 1977	148.67	60.90	101.0	8.22	10.34	2.12	13.0	7.0	6.0	2.5
II	149.67	63.20	99.0	8.61	10.47	1.86	12.5	8.1	6.0	3.3
III	133.67	56.80	102.0	8.68	10.73	2.05	12.6	6.9	4.7	3.5
IV	129.67	48.20	97.0	8.80	10.81	2.01	13.3	6.6	5.1	2.3
I 1978	135.00	50.50	108.0	9.00	10.96	1.96	13.0	7.2	6.0	2.5
II	137.67	51.40	109.0	9.25	11.22	1.97	12.5	8.2	5.6	3.4
III	137.33	49.20	107.0	9.64	11.39	1.75	12.5	7.2	3.9	3.5
IV	142.00	47.10	105.0	10.41	12.02	1.61	13.2	7.3	4.2	2.4
I 1979	148.67	48.90	117.0	10.55	12.63	2.07	13.3	7.6	5.4	2.5
II	150.33	49.90	117.0	10.69	12.68	2.00	12.5	8.5	5.4	3.3
III	160.33	56.00	117.0	11.09	12.87	1.78	12.3	7.8	3.9	3.4
IV	163.67	60.80	117.0	11.29	13.32	2.03	13.3	7.6	4.7	2.4
I 1980	164.33	59.10	126.0	11.44	13.44	2.00	13.1	8.0	6.0	2.6
II	165.33	60.10	126.0	11.67	13.65	1.98	12.3	8.9	6.4	3.2
III	179.33	66.50	126.0	11.89	13.79	1.91	12.4	8.2	4.7	3.5

	16% Dairy Feed ($/ton)	All Hay Price ($/ton)	Wage Paid by Farmers (77=100)	Class II Price ($/cwt)	Class I Price ($/cwt)	Class I Differ-ential ($/cwt)	Fluid Demand/ Supply ME Fat (bil lbs)	Cheese Supply ME Fat (bil lbs)	Butter Supply ME Fat (bil lbs)	Frozen Demand/ Supply ME Fat (bil lbs)
IV 1980	198.33	75.80	126.0	12.52	14.22	1.70	13.1	8.6	5.6	2.5
I 1981	200.00	72.80	137.0	12.66	14.70	2.05	12.8	8.9	7.0	2.6
II	198.00	68.20	137.0	12.61	14.77	2.15	12.2	9.9	6.6	3.4
III	188.67	64.00	137.0	12.49	14.69	2.20	12.2	8.8	5.0	3.6
IV	181.33	64.80	137.0	12.53	14.62	2.09	12.9	9.0	6.0	2.5
I 1982	180.00	67.90	144.0	12.49	14.69	2.21	12.6	9.2	7.3	2.6
II	179.67	73.30	144.0	12.43	14.61	2.17	12.0	10.3	6.6	3.4
III	176.67	66.10	144.0	12.44	14.57	2.13	12.0	9.6	5.1	3.6
IV	172.33	67.10	144.0	12.58	14.64	2.06	12.7	9.7	6.0	2.6
I 1983	175.67	70.30	148.0	12.58	14.76	2.18	12.5	9.9	7.6	2.7
II	183.33	74.00	148.0	12.51	14.70	2.19	12.0	11.0	6.9	3.5
III	189.67	71.20	148.0	12.49	14.65	2.17	12.2	9.8	5.2	3.8
IV	203.00	76.80	148.0	12.40	14.64	2.25	12.9	9.9	6.0	2.6
I 1984	201.67	76.60	151.0	12.06	14.40	2.33	12.9	9.6	6.7	2.8
II	197.00	79.80	151.0	12.08	14.23	2.15	12.3	10.4	5.6	3.6
III	188.00	72.40	154.0	12.37	14.27	1.90	12.3	9.2	4.1	3.6
IV	177.33	73.10	150.0	12.63	14.71	2.08	13.1	8.7	5.8	2.6
I 1985	174.33	73.00	154.0	12.19	14.73	2.54	13.1	8.8	7.4	2.7
II	169.67	72.50	158.0	11.43	14.10	2.67	12.6	10.0	7.2	3.7
III	165.33	67.90	154.0	11.10	13.41	2.31	12.8	9.5	6.2	3.8
IV	163.33	67.50	150.0	11.19	13.30	2.10	13.5	9.4	7.3	2.7
I 1986	167.00	65.80	150.0	11.06	13.33	2.27	13.3	9.5	8.4	2.9
II	164.00	66.20	164.0	10.99	13.45	2.46	12.9	10.3	7.4	3.8
III	159.00	58.40	166.0	11.31	13.56	2.25	13.0	9.4	5.2	3.8
IV	151.00	56.90	159.0	11.83	14.07	2.24	13.5	9.1	6.0	2.7
I 1987	153.00	58.10	159.0	11.33	14.39	3.06	13.5	9.3	7.1	3.0
II	152.00	73.70	160.0	11.02	13.66	2.64	13.0	10.3	6.4	3.9
III	154.00	61.80	161.0	11.29	13.62	2.33	13.1	9.6	5.0	3.9
IV	156.00	62.10	162.0	11.27	13.89	2.62	13.8	9.7	6.5	2.6
I 1988	166.00	64.87	171.8	10.65	13.69	3.04	13.9	9.8	8.1	2.8
II	166.00	76.03	174.9	10.34	12.99	2.65	13.2	10.4	7.0	3.7
III	199.00	81.97	179.1	10.99	12.94	1.95	13.5	9.7	5.3	3.8
IV	197.00	86.37	181.2	12.13	14.00	1.87	14.0	10.3	6.3	2.8
I 1989	196.00	92.70	182.4	11.38	14.69	3.31	14.1	10.1	8.3	3.1
II	192.00	97.07	184.5	11.18	13.67	2.49	13.5	10.5	7.2	3.9
III	184.00	83.57	185.5	12.41	13.95	1.54	13.5	9.9	4.9	3.8
IV	182.00	83.30	184.5	14.50	15.66	1.16	14.3	10.3	6.2	2.9
I 1990	186.00	86.03	188.4	12.72	17.09	4.37	14.0	10.8	7.9	3.0
II	181.00	93.87	190.5	12.79	14.76	1.97	13.3	11.6	7.0	3.8
III	181.00	84.40	191.5	13.01	15.73	2.72	13.5	10.7	5.3	3.8
IV	181.00	82.17	194.6	10.31	14.60	4.29	14.6	11.1	7.1	2.7
SOURCE	(1)	(1)	(1)	(1)	(1)	(8)	(2)	(2)	(2)	(2)

	Cheese Demand ME Fat (bil lbs)	Butter Demand ME Fat (bil lbs)	Cheese Inventories ME Fat (bil lbs)	Butter Inventories ME Fat (bil lbs)	CCC Cheese Purchases ME Fat (bil lbs)	CCC Butter Purchases ME Fat (bil lbs)	Govt Purchase Cheese Price (cts/lb)	Govt Purchase Butter Price (cts/lb)	Wholesale Cheese Price (cts/lb)
I 1970	4.1	4.8	2.6	0.6	0.1	1.2	0.48	0.68	0.55
II	5.0	4.2	3.0	0.8	0.1	2.7	0.52	0.70	0.53
III	4.3	4.4	3.3	0.7	0.2	0.9	0.52	0.70	0.53
IV	4.9	5.2	2.9	0.4	0.0	0.4	0.52	0.70	0.57
I 1971	4.9	3.9	2.7	0.6	0.1	2.5	0.52	0.70	0.57
II	5.5	4.8	3.0	0.6	0.2	2.4	0.55	0.68	0.57
III	4.6	4.1	3.3	0.6	0.3	1.0	0.55	0.68	0.56
IV	5.2	4.8	2.8	0.7	0.2	0.3	0.55	0.68	0.57
I 1972	5.6	4.6	2.5	0.5	0.1	1.8	0.55	0.68	0.59
II	5.9	4.2	3.0	0.6	0.1	2.6	0.55	0.68	0.58
III	5.1	4.4	3.6	0.5	0.1	0.5	0.55	0.68	0.60
IV	5.6	5.0	3.1	0.3	0.0	-0.1	0.55	0.68	0.63
I 1973	5.9	3.9	2.8	0.4	0.0	1.5	0.57	0.65	0.64
II	6.6	4.9	3.0	0.7	0.0	0.4	0.62	0.61	0.67
III	5.2	3.3	3.4	0.9	0.0	0.1	0.64	0.61	0.75
IV	5.8	4.7	3.2	0.1	0.0	0.0	0.65	0.61	0.86
I 1974	6.2	3.7	3.5	0.9	0.0	0.1	0.65	0.61	0.91
II	6.2	4.5	4.7	1.7	0.0	0.4	0.71	0.61	0.78
III	5.6	4.0	4.8	1.8	0.3	0.2	0.71	0.61	0.73
IV	5.7	5.6	4.4	0.9	0.2	0.0	0.71	0.61	0.76
I 1975	5.8	5.3	3.9	0.7	0.3	0.8	0.77	0.68	0.76
II	6.6	5.0	3.9	0.8	0.2	0.9	0.79	0.69	0.81
III	5.9	4.2	3.8	0.6	0.0	-0.4	0.79	0.69	0.90
IV	6.3	4.7	3.2	0.2	0.0	0.0	0.85	0.80	1.00
I 1976	6.7	5.1	3.1	0.4	0.0	0.0	0.85	0.80	0.95
II	7.4	4.4	3.8	1.2	0.0	0.0	0.90	0.86	0.96
III	6.6	4.1	4.5	1.1	0.1	0.0	0.90	0.86	1.01
IV	6.8	4.5	4.2	0.7	0.2	0.8	0.93	0.91	0.93
I 1977	6.7	4.5	4.0	0.8	0.5	1.5	0.93	0.91	0.93
II	7.3	3.4	4.5	1.2	0.4	2.1	0.98	1.01	0.98
III	6.5	4.2	4.6	1.1	0.4	0.6	0.98	1.01	0.98
IV	7.5	5.1	3.8	0.8	0.0	0.3	0.98	1.01	0.99
I 1978	7.5	4.6	3.5	1.1	0.0	1.1	0.98	1.01	1.01
II	7.7	4.1	3.8	0.9	0.2	1.6	1.03	1.07	1.03
III	6.8	4.4	4.0	0.7	0.1	-0.2	1.03	1.07	1.08
IV	7.6	4.7	3.7	0.4	0.0	-0.2	1.06	1.11	1.17
I 1979	7.5	5.1	3.8	0.5	0.0	0.2	1.06	1.11	1.19
II	8.0	4.1	4.2	0.9	0.0	1.0	1.16	1.22	1.21
III	7.2	3.8	4.7	1.1	0.1	0.0	1.16	1.22	1.28
IV	7.6	4.7	4.4	0.6	0.2	0.5	1.24	1.31	1.27
I 1980	7.7	5.2	4.2	0.7	0.5	0.8	1.24	1.31	1.27
II	8.2	2.9	4.4	1.0	0.6	3.1	1.33	1.41	1.31
III	6.9	4.6	4.6	0.9	1.1	0.2	1.33	1.41	1.32

	Cheese Demand ME Fat (bil lbs)	Butter Demand ME Fat (bil lbs)	Cheese Inventories ME Fat (bil lbs)	Butter Inventories ME Fat (bil lbs)	CCC Cheese Purchases ME Fat (bil lbs)	CCC Butter Purchases ME Fat (bil lbs)	Govt Purchase Cheese Price (cts/lb)	Govt Purchase Butter Price (cts/lb)	Wholesale Cheese Price (cts/lb)
IV 1980	8.5	4.6	4.3	0.9	0.4	1.0	1.39	1.49	1.41
I 1981	7.7	4.0	4.4	1.0	1.1	2.9	1.39	1.49	1.39
II	7.9	4.1	4.5	1.0	1.9	2.5	1.39	1.49	1.39
III	7.8	4.5	4.3	0.8	1.2	0.7	1.39	1.49	1.39
IV	8.8	4.9	3.9	1.0	0.6	0.9	1.39	1.49	1.40
I 1982	8.1	4.0	3.9	1.0	1.1	3.3	1.39	1.49	1.38
II	11.0	4.5	1.3	0.5	1.9	2.6	1.39	1.49	1.37
III	8.2	4.3	1.2	0.5	1.5	0.8	1.39	1.49	1.38
IV	8.7	5.0	1.2	0.6	1.0	0.9	1.39	1.49	1.40
I 1983	5.4	4.1	4.0	0.6	1.8	3.4	1.39	1.49	1.39
II	8.6	3.9	4.1	0.7	2.3	3.0	1.39	1.49	1.37
III	7.9	4.4	4.1	0.6	1.9	0.9	1.39	1.49	1.38
IV	9.0	5.0	4.0	0.6	1.1	0.9	1.38	1.47	1.39
I 1984	8.5	3.7	3.8	0.9	1.2	2.8	1.35	1.43	1.36
II	8.9	4.7	3.9	0.9	1.5	0.9	1.35	1.43	1.36
III	8.6	4.1	3.8	0.8	0.7	0.0	1.35	1.43	1.40
IV	8.6	5.8	3.6	0.7	0.3	0.2	1.35	1.43	1.40
I 1985	7.9	4.3	3.4	0.9	1.1	2.9	1.35	1.43	1.34
II	8.5	4.6	3.4	1.0	1.5	2.4	1.29	1.43	1.28
III	8.3	5.3	3.4	0.9	1.3	1.0	1.24	1.40	1.24
IV	8.9	6.2	3.1	0.8	0.9	1.2	1.24	1.40	1.24
I 1986	8.5	4.4	3.0	1.0	1.1	3.9	1.25	1.40	1.24
II	8.7	4.9	3.2	1.0	1.5	2.5	1.25	1.40	1.25
III	8.6	5.3	3.3	0.9	0.7	0.0	1.25	1.40	1.29
IV	9.4	6.0	2.8	0.8	0.2	0.2	1.25	1.40	1.31
I 1987	8.8	5.1	2.8	0.8	0.6	2.1	1.23	1.38	1.24
II	9.3	5.3	3.2	1.1	0.6	0.7	1.23	1.38	1.22
III	9.2	4.6	3.3	1.2	0.3	0.2	1.23	1.38	1.25
IV	9.5	5.4	2.9	1.1	0.6	1.2	1.20	1.36	1.21
I 1988	9.2	4.4	2.7	1.4	0.8	3.4	1.15	1.32	1.17
II	9.5	4.8	2.9	1.4	0.7	2.2	1.15	1.32	1.15
III	9.6	4.9	2.9	1.4	0.2	0.4	1.15	1.32	1.27
IV	10.5	5.7	2.5	1.0	0.1	1.0	1.15	1.32	1.36
I 1989	9.7	4.0	2.8	1.2	0.1	4.1	1.15	1.32	1.22
II	10.2	3.2	3.0	1.6	0.1	3.6	1.20	1.32	1.25
III	10.0	4.5	2.9	1.8	0.0	0.2	1.15	1.21	1.47
IV	10.8	6.0	2.4	1.3	0.0	0.8	1.15	1.21	1.62
I 1990	10.4	4.4	2.7	1.2	0.0	3.7	1.11	1.09	1.38
II	11.1	4.4	3.2	1.1	0.0	2.7	1.11	0.98	1.45
III	10.5	4.6	3.4	0.9	0.0	0.9	1.11	0.98	1.48
IV	11.2	6.0	3.2	0.9	0.2	1.1	1.11	0.98	1.13
SOURCE	(3)	(3)	(4)	(4)	(6)	(6)	(2)	(2)	(2)

	Wholesale Butter Price (cts/lb)	Wholesale Fluid Price 82=100	Wholesale Frozen Price 82=100	Manufacture Food Hourly Wage ($/hr)	Retail Food Hourly Wage ($/hr)	Producer Price for Fuel&Energy (67=100)	CPI Fresh Milk & Cream 82-84=100	CPI Cheese 82-84=100
I 1970	0.68	54.6	44.14	3.09	2.64	14.8	49.5	37.2
II	0.70	55.0	44.47	3.14	2.68	15.1	49.6	37.8
III	0.70	55.4	44.59	3.16	2.73	15.5	49.7	38.0
IV	0.70	54.7	44.78	3.24	2.78	16.3	50.2	38.4
I 1971	0.70	55.0	45.38	3.33	2.85	16.3	50.5	39.1
II	0.68	56.2	45.99	3.38	2.92	16.5	51.2	39.6
III	0.68	56.4	46.26	3.37	2.98	16.6	51.4	39.9
IV	0.68	56.4	46.26	3.43	3.02	16.6	51.4	40.0
I 1972	0.68	56.4	46.38	3.54	3.10	16.8	51.9	40.3
II	0.68	55.9	46.60	3.59	3.15	17.1	52.1	40.7
III	0.69	56.7	46.31	3.58	3.20	17.4	51.6	40.9
IV	0.70	56.6	46.14	3.69	3.26	17.6	51.9	41.4
I 1973	0.67	57.8	46.37	3.78	3.31	18.3	53.4	42.4
II	0.61	58.1	46.61	3.83	3.35	20.6	54.3	43.9
III	0.76	58.1	47.77	3.85	3.39	20.9	56.2	45.1
IV	0.75	59.5	50.31	3.95	3.48	29.1	63.4	49.9
I 1974	0.67	63.8	51.01	4.05	3.62	27.3	67.4	54.6
II	0.63	65.0	53.59	4.15	3.68	30.4	69.8	56.5
III	0.65	63.5	54.92	4.23	3.79	32.5	67.7	53.6
IV	0.68	64.0	57.66	4.35	3.87	33.1	67.9	54.4
I 1975	0.68	64.7	58.99	4.49	3.98	33.6	68.8	55.2
II	0.69	64.9	58.35	4.56	4.05	35.1	67.5	55.7
III	0.83	65.4	58.69	4.63	4.09	36.8	67.2	57.5
IV	0.98	67.1	60.18	4.73	4.19	37.2	69.6	62.5
I 1976	0.84	69.5	62.24	4.86	4.30	36.9	71.8	64.7
II	0.91	69.7	62.30	4.92	4.37	37.6	71.5	64.2
III	1.01	70.1	63.57	5.01	4.43	39.1	71.5	65.0
IV	0.91	71.1	64.01	5.10	4.53	40.3	72.8	65.9
I 1977	0.91	70.5	64.40	5.24	4.65	42.4	72.3	63.4
II	1.00	71.1	66.81	5.31	4.73	43.9	72.4	64.2
III	1.01	71.8	67.37	5.40	4.80	44.7	72.6	65.0
IV	1.01	72.3	68.28	5.52	4.94	45.0	73.2	65.8
I 1978	1.01	73.1	69.00	5.67	5.11	45.5	74.1	69.2
II	1.06	75.1	71.58	5.74	5.18	46.7	76.0	70.7
III	1.13	76.6	72.64	5.83	5.26	47.2	77.3	72.1
IV	1.19	80.1	74.42	5.96	5.41	48.3	80.0	75.1
I 1979	1.12	83.4	77.35	6.10	5.56	50.7	82.9	77.9
II	1.21	84.5	78.95	6.20	5.62	56.8	84.2	79.6
III	1.26	86.3	81.01	6.29	5.68	65.7	86.2	81.3
IV	1.30	88.9	83.34	6.47	5.80	70.4	89.2	83.6
I 1980	1.30	90.4	84.90	6.64	5.93	79.9	90.7	85.1
II	1.37	91.7	89.90	6.80	6.07	83.2	92.6	87.4
III	1.43	92.7	91.18	6.91	6.34	85.7	93.8	89.6

	Wholesale Butter Price (cts/lb)	Wholesale Fluid Price 82=100	Wholesale Frozen Price 82=100	Manufacture Food Hourly Wage ($/hr)	Retail Food Hourly Wage ($/hr)	Producer Price for Fuel&Energy (67=100)	CPI Fresh Milk & Cream 82-84=100	CPI Cheese 82-84=100
IV 1980	1.47	95.0	94.27	7.04	6.58	88.9	95.7	92.8
I 1981	1.47	98.0	97.95	7.23	6.75	100.5	98.1	95.2
II	1.47	98.0	98.79	7.39	6.84	102.2	98.8	96.2
III	1.48	98.2	99.04	7.50	6.96	101.6	98.8	96.4
IV	1.49	98.8	99.08	7.60	6.87	101.4	98.9	96.6
I 1982	1.48	99.5	98.90	7.78	7.03	99.6	99.2	97.7
II	1.47	99.9	99.93	7.92	7.17	97.8	99.4	98.4
III	1.48	100.1	100.13	7.88	7.27	101.1	99.3	99.0
IV	1.48	100.5	101.04	7.98	7.35	101.5	99.2	99.0
I 1983	1.45	101.0	101.43	8.14	7.43	96.7	100.2	99.5
II	1.47	101.0	101.85	8.21	7.47	94.4	100.1	100.2
III	1.49	100.8	101.49	8.16	7.54	96.9	99.9	100.5
IV	1.46	100.9	101.93	8.25	7.60	95.8	99.6	100.4
I 1984	1.41	100.9	102.67	8.37	7.64	94.6	100.1	100.5
II	1.45	100.8	103.86	8.41	7.66	95.3	100.2	100.5
III	1.55	101.2	105.44	8.36	7.63	95.0	100.5	101.6
IV	1.54	103.0	105.74	8.40	7.66	94.2	102.4	102.7
I 1985	1.41	103.8	106.00	8.54	7.54	90.8	103.1	103.1
II	1.42	103.0	105.98	8.60	7.38	92.5	102.6	102.8
III	1.41	102.0	105.66	8.53	7.27	91.0	102.0	103.6
IV	1.40	103.2	106.08	8.61	7.24	91.5	101.4	103.4
I 1986	1.38	101.5	106.45	8.73	7.23	81.8	101.2	103.3
II	1.39	101.6	107.47	8.76	7.08	69.8	101.3	103.2
III	1.51	102.2	107.61	8.70	6.96	64.3	101.7	103.7
IV	1.50	104.1	108.50	8.79	6.98	63.4	102.9	104.1
I 1987	1.37	105.8	110.20	8.91	6.95	67.7	103.8	105.3
II	1.41	104.1	111.37	8.94	6.94	70.1	103.6	105.7
III	1.47	104.1	111.60	8.88	6.96	73.1	103.7	106.0
IV	1.35	105.5	111.60	8.95	6.96	73.1	105.2	106.8
I 1988	1.31	105.1	111.70	9.06	6.98	66.6	105.3	107.7
II	1.32	104.8	110.03	9.13	6.97	68.2	105.2	108.0
III	1.35	105.7	110.53	9.08	6.95	67.2	106.0	109.0
IV	1.32	109.3	111.27	9.14	7.11	64.8	108.8	114.6
I 1989	1.31	112.0	113.87	9.29	7.13	69.0	112.4	113.9
II	1.31	110.7	114.60	9.34	7.12	75.3	112.8	114.6
III	1.29	112.3	116.47	9.31	7.09	73.8	113.4	116.9
IV	1.20	119.4	121.10	9.42	7.22	73.4	119.2	124.8
I 1990	1.09	125.9	122.97	9.54	7.33	77.1	127.5	129.6
II	1.01	121.2	123.23	9.62	7.34	73.4	124.6	129.3
III	0.99	124.6	123.37	9.58	7.32	82.0	126.4	132.4
IV	0.99	123.9	122.80	9.73	7.50	96.1	127.4	133.4
SOURCE	(2)	(1)	(2)	(1)	(1)	(1)	(2)	(2)

	CPI Butter 82-84=100	CPI Frozen Products 82-84=100	CPI All Items 82-84=100	CPI Food 82-84=100	CPI Meat 82-84=100	CPI Fats & Oils 82-84=100	CPI Non-Alch Beverages 82-84=100	Dispos Personal Income (bil $)	Total Popula (mil)
I 1970	41.0	41.3	38.0	38.8	43.3	37.3	25.8	667.9	203.2
II	41.3	41.8	38.6	39.2	43.6	39.1	26.9	687.2	204.1
III	41.6	42.2	39.1	39.5	43.6	39.6	27.6	699.1	205.0
IV	41.9	42.4	39.6	39.3	42.6	40.9	28.1	704.0	205.9
I 1971	42.0	42.1	39.9	39.6	42.4	43.1	28.1	725.7	206.8
II	41.9	42.2	40.3	40.3	43.2	43.7	28.2	742.9	207.4
III	41.9	42.4	40.8	40.8	44.1	43.1	28.1	750.4	208.1
IV	41.8	42.5	41.0	40.7	44.0	43.6	27.9	758.5	208.7
I 1972	41.8	42.5	41.3	41.4	46.3	43.5	27.9	774.7	209.3
II	41.6	42.5	41.6	41.8	46.7	43.3	27.9	790.0	209.8
III	41.4	42.4	42.0	42.4	48.5	42.8	27.9	807.2	210.3
IV	41.7	42.5	42.4	42.7	48.8	42.7	28.4	838.1	210.8
I 1973	41.8	43.3	42.9	44.8	53.5	42.7	28.9	866.6	211.4
II	40.8	44.0	43.9	47.0	57.9	44.2	29.9	891.7	211.9
III	43.6	46.0	44.9	49.8	64.6	46.4	30.5	914.1	212.3
IV	49.1	49.3	45.9	51.1	62.4	53.6	31.0	939.9	212.8
I 1974	46.6	50.3	47.2	53.4	63.8	57.1	32.2	953.8	213.3
II	44.8	53.0	48.5	54.4	59.2	63.1	34.5	968.2	213.9
III	43.7	56.2	50.0	55.5	59.8	67.7	37.6	996.3	214.4
IV	45.7	58.7	51.5	57.2	60.8	77.3	39.4	1015.9	214.9
I 1975	45.0	60.6	52.4	58.4	60.4	79.3	40.8	1025.4	215.5
II	45.7	60.1	53.2	58.8	62.8	75.1	40.7	1092.2	216.0
III	48.6	60.3	54.4	60.7	70.3	70.4	40.6	1095.7	216.5
IV	56.9	61.8	55.2	61.3	71.0	69.3	43.2	1124.1	217.0
I 1976	59.1	62.4	55.8	61.3	68.1	66.0	44.3	1152.5	217.6
II	57.6	62.2	56.5	61.4	67.1	63.2	46.9	1170.6	218.1
III	62.8	63.5	57.4	62.1	67.5	62.9	51.3	1192.8	218.7
IV	61.7	64.6	58.0	61.8	64.0	65.0	55.1	1221.5	219.2
I 1977	60.7	65.3	59.0	63.6	64.6	66.5	62.9	1250.1	219.8
II	63.4	67.6	60.3	65.5	65.5	69.9	76.6	1286.0	220.3
III	64.8	68.7	61.2	66.4	67.4	74.0	80.2	1332.2	220.9
IV	65.7	71.0	61.9	66.6	67.5	72.9	78.1	1361.2	221.5
I 1978	66.5	73.3	62.9	68.8	71.1	73.7	78.4	1398.0	222.1
II	68.4	75.2	64.5	71.8	77.6	76.9	79.0	1440.7	222.7
III	71.1	77.2	66.1	73.4	79.8	79.4	78.7	1482.1	223.3
IV	75.2	79.1	67.4	74.3	81.0	80.3	78.7	1513.0	223.9
I 1979	76.3	81.1	69.1	77.5	87.3	81.0	80.0	1580.2	224.6
II	77.9	85.5	71.5	79.8	91.5	83.2	80.6	1612.8	225.1
III	80.2	88.4	73.8	80.7	88.8	84.8	83.4	1663.8	225.8
IV	83.9	90.8	75.9	81.7	88.0	86.0	86.3	1710.1	226.4
I 1980	85.4	94.3	78.9	83.6	90.3	87.2	88.5	1766.9	227.1
II	87.2	95.3	81.8	85.4	88.8	88.5	90.7	1781.0	227.7
III	90.7	96.4	83.3	88.0	93.1	89.4	92.7	1845.5	228.2

	CPI Butter 82-84=100	CPI Frozen Products 82-84=100	CPI All Items 82-84=100	CPI Food 82-84=100	CPI Meat 82-84=100	CPI Fats & Oils 82-84=100	CPI Non-Alch Beverages 82-84=100	Dispos Personal Income (bil $)	Total Popula (mil)
IV 1980	94.3	97.5	85.5	90.1	96.6	91.9	93.6	1902.9	228.8
I 1981	95.1	97.7	87.8	92.2	95.9	98.3	95.0	1967.6	229.3
II	96.0	97.4	89.8	93.0	94.3	100.0	95.4	2010.4	229.8
III	96.6	97.7	92.4	94.4	97.4	99.5	95.2	2092.0	230.4
IV	97.2	98.6	93.7	94.6	96.6	97.7	95.5	2120.5	230.9
I 1982	97.8	99.0	94.5	96.3	96.9	96.4	97.5	2207.2	231.5
II	98.3	99.7	95.9	97.4	99.9	96.4	98.1	2241.8	232.0
III	98.7	99.5	97.7	98.1	102.2	95.7	97.8	2278.6	232.5
IV	98.9	100.7	97.9	97.7	100.6	95.7	98.4	2318.1	233.0
I 1983	99.4	101.0	97.9	98.6	100.7	95.7	99.7	2345.5	233.7
II	99.5	101.9	99.1	99.6	100.4	95.6	99.6	2387.7	234.2
III	99.5	102.8	100.3	99.6	98.6	96.4	99.3	2447.9	234.7
IV	100.0	103.8	101.2	99.9	97.2	101.7	100.5	2520.4	235.3
I 1984	99.7	105.6	102.3	102.7	101.1	103.8	101.9	2610.2	236.1
II	99.4	105.7	103.4	102.9	100.8	104.9	102.2	2649.9	236.7
III	103.5	105.6	104.5	103.6	101.0	108.8	102.2	2696.7	237.2
IV	105.5	106.0	105.3	103.8	100.6	108.7	102.8	2728.6	237.8
I 1985	103.9	107.0	106.0	105.2	102.0	109.3	104.4	2762.2	238.4
II	102.6	106.6	107.3	105.4	99.9	109.0	104.6	2848.4	238.9
III	103.0	107.2	108.0	105.5	99.3	109.7	103.9	2847.2	239.5
IV	102.8	108.9	109.0	106.1	101.0	107.8	104.2	2899.5	240.1
I 1986	102.6	110.8	109.2	107.5	102.4	108.0	110.3	2965.1	240.6
II	101.7	110.8	109.0	107.9	100.8	106.4	111.5	3016.3	241.2
III	103.3	111.2	109.8	109.7	107.2	106.2	110.1	3032.4	241.7
IV	104.6	111.5	110.4	110.6	109.1	105.5	109.6	3063.4	242.4
I 1987	103.9	112.4	111.6	112.4	109.9	108.3	110.8	3142.8	242.9
II	102.1	112.8	113.1	113.3	110.9	108.1	107.8	3138.1	243.4
III	102.0	113.4	114.4	113.9	113.4	108.1	105.9	3223.5	244.0
IV	104.1	114.6	115.4	114.4	112.5	107.7	105.5	3302.3	244.6
I 1988	103.6	116.3	116.1	115.8	112.4	109.4	107.4	3378.6	245.5
II	102.8	118.4	117.5	117.1	114.6	110.9	107.5	3439.4	246.0
III	103.8	118.7	119.1	119.5	118.1	114.4	107.2	3520.1	246.7
IV	102.6	121.9	120.3	120.4	117.3	117.4	107.8	3578.9	247.3
I 1989	102.5	125.4	121.7	122.9	119.4	120.1	110.7	3661.7	247.9
II	102.5	126.4	123.7	124.7	121.3	121.5	111.6	3697.3	248.4
III	102.2	127.2	124.7	125.8	122.5	121.4	111.5	3743.4	249.1
IV	100.8	128.4	125.9	126.9	122.5	121.3	111.3	3799.6	249.8
I 1990	99.3	132.1	128.0	131.1	125.1	123.4	113.2	3887.7	250.4
II	95.2	133.1	129.3	131.5	128.3	124.8	113.1	3925.7	251.0
III	93.7	134.0	131.6	132.9	131.3	127.0	114.5	3969.1	251.8
IV	92.8	135.2	133.7	133.9	132.9	128.2	114.8	4000.9	252.5
SOURCE	(2)	(2)	(2)	(2)	(2)	(1)	(2)	(1)	(1)

	Deflated Generic Fluid Advert (1000)	Deflated Brand Fluid Advert (1000)	Deflated Generic Cheese Advert (1000)	Deflated Brand Cheese Advert (1000)	Deflated Generic Butter Advert (1000)	Deflated Brand Butter Advert (1000)	Deflated Generic Frozen Advert (1000)	Deflated Brand Frozen Advert (1000)
I 1970								
II								
III								
IV								
I 1971								
II								
III								
IV								
I 1972								
II								
III								
IV								
I 1973								
II								
III								
IV								
I 1974								
II								
III								
IV								
I 1975	4,087	2,444	7	4,909	3	294	0	853
II	3,213	1,250	128	3,710	5	255	0	2,031
III	2,794	1,578	123	3,373	0	182	0	2,083
IV	2,842	1,372	458	5,798	0	238	0	802
I 1976	3,353	1,874	115	3,354	8	252	0	883
II	3,137	1,626	104	4,144	6	335	0	2,842
III	4,790	1,735	96	4,230	0	166	0	3,012
IV	1,794	1,516	364	4,760	3	292	0	1,313
I 1977	3,614	1,062	7	3,742	2	366	0	1,514
II	2,773	1,355	154	3,926	7	345	0	2,568
III	2,640	687	143	3,187	13	121	0	2,658
IV	2,886	507	322	4,629	24	592	0	553
I 1978	3,680	472	21	4,654	0	362	0	1,806
II	2,594	416	167	5,696	0	277	0	2,716
III	2,101	368	49	4,628	0	60	0	2,841
IV	3,379	213	321	6,572	0	485	0	940
I 1979	8,002	1,630	152	11,870	0	716	0	5,671
II	3,740	938	136	5,863	0	334	0	3,326
III	3,521	643	45	6,401	0	79	0	2,146
IV	3,209	1,001	279	7,408	0	517	0	733
I 1980	3,301	230	69	8,565	0	328	0	1,343
II	3,368	227	156	5,765	0	300	0	2,281
III	3,256	282	171	5,571	0	114	0	1,732

	Deflated Generic Fluid Advert (1000)	Deflated Brand Fluid Advert (1000)	Deflated Generic Cheese Advert (1000)	Deflated Brand Cheese Advert (1000)	Deflated Generic Butter Advert (1000)	Deflated Brand Butter Advert (1000)	Deflated Generic Frozen Advert (1000)	Deflated Brand Frozen Advert (1000)
IV 1980	4,035	249	276	8,317	0	388	0	503
I 1981	2,936	285	380	8,535	0	226	0	568
II	2,823	473	521	7,795	0	269	0	1,923
III	2,491	376	1,601	6,993	0	251	0	2,027
IV	1,513	781	2,977	7,085	0	345	0	711
I 1982	997	524	2,424	8,107	0	132	0	654
II	1,041	219	2,940	8,258	0	376	0	2,579
III	612	362	3,354	8,529	0	225	0	2,887
IV	2,629	596	2,822	9,540	0	411	0	827
I 1983	1,815	561	1,496	10,572	0	691	0	817
II	1,749	654	2,141	7,163	0	56	0	3,453
III	1,297	934	2,277	8,932	0	217	0	5,060
IV	1,466	1,275	3,556	5,042	0	1,009	0	711
I 1984	2,569	1,184	573	8,878	0	328	0	2,442
II	2,007	1,828	1,564	9,758	0	437	0	5,286
III	2,462	652	951	8,125	233	101	497	6,758
IV	3,538	759	1,551	8,052	2,001	389	0	1,372
I 1985	2,572	954	7,353	8,537	1,058	385	0	789
II	1,531	464	4,523	7,997	851	140	0	7,035
III	1,724	422	2,397	8,260	0	177	13	8,324
IV	963	662	5,595	10,332	1,137	443	0	1,034
I 1986	5,306	644	4,791	6,560	1,752	341	0	1,550
II	4,880	992	4,582	6,815	1,881	53	37	10,053
III	3,422	614	745	7,200	527	124	120	10,636
IV	4,896	835	4,450	8,825	1,610	434	0	2,571
I 1987	4,498	462	4,491	6,696	1,558	154	14	1,695
II	4,456	301	4,970	5,627	869	180	1,271	12,136
III	3,742	514	1,103	4,588	693	631	981	9,326
IV	4,409	548	3,423	2,391	2,489	922	28	1,533
I 1988	4,856	577	2,849	10,031	890	917	81	2,235
II	3,889	740	4,287	7,591	1,326	504	1,141	9,691
III	3,625	742	2,390	9,854	1,932	859	991	9,507
IV	3,954	557	4,123	8,467	1,730	761	64	1,550
I 1989	4,001	702	2,706	8,869	1,491	814	75	3,055
II	4,440	679	3,666	8,318	1,355	515	662	8,690
III	4,694	720	2,208	8,657	1,511	269	1,040	6,514
IV	4,604	482	3,789	6,939	1,397	634	62	1,071
I 1990	3,663	1,257	3,223	13,549	710	19	627	763
II	2,946	642	3,120	10,676	531	342	937	5,936
III	3,094	1,118	3,642	8,444	373	50	1,591	5,676
IV	2,932	1,095	3,918	5,446	1,536	251	228	1,289
SOURCE	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)

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