RURAL ECONOMY

Canadian Dairy Demand

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Project Report 97-03

Alberta Agricultural Research Institute Project No. 940503

PROJECT REPORT

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Abstract

The Canadian dairy industry faces a changing market environment as processors react to apparent shifts in consumers' preferences, consumers react to an altered mix of products on retail dairy shelves, and industry adjusts to potential pressures of competition and the challenge of new market opportunities under the impetus of changes arising from international trade. The purpose of this study is to derive a set of updated and disaggregated estimates of demand for major dairy products in a manner consistent with the economic theory of consumer behaviour. These estimates are necessary for policy models, policy analysis and forecasting. Previously dairy demand estimates were only available for broad product groupings such as fluid milk, butter, all cheese and "all other dairy products".

For this study, four weakly separable groupings of major dairy products and related foods are specified. These are milk and other beverages, fats and oils, dairy dessert and related products and cheeses and apparent substitutes. Skim milk powder is assessed not to be a member of any of these groups but is hypothesized to be a member of a fifth dairy subgroup of dairy protein products. Due to data limitations, it was necessary to follow a single-equation approach for this product.

The appropriateness of each product grouping was assessed by a two-stage test. First, each subgroup was tested using non-parametric tests of the axioms of revealed preference, as a means of inferring whether or not choices within each subgrouping are consistent with constrained utility maximization. Second, parametric assessment of each subgroup gave further evidence regarding the appropriateness of the groupings in terms of whether the estimated demand parameters are relatively stable and plausible. Based on satisfactory performance in these tests, parametric analyses for each subgroup were conducted using the linearized version of the almost ideal demand system, incorporating appropriate seasonality and habit formation variables.

Estimates of own-price, cross-price and expenditure elasticities of demand are derived and presented. In general these seem plausible. Signs on the own-price elasticity estimates are as expected; the magnitudes

appear to be reasonable. As expected, the majority of the specified foods are price-inelastic. However, butter, cooking/salad oil and other cheese appear to be price-elastic. Yogurt, concentrated milk and ice cream are fairly expenditure elastic while the two cheese types and butter appear slightly expenditure elastic. A summary of own-price and expenditure elasticities is given in the following table (Table 25 of the report).

Summary of Own Price and Expenditure Elasticity Estimates[1]

Product	Own-Price Elasticity	Expenditure Elasticity
	Group I	
Whole Milk	-0.59** (0.18)	0.06 (0.07)
Low-Fat Milk	-0.11 (0.10)	0.06 (0.07)
Soft Drink	-0.98** (0.15)	1.79** (0.20)
Coffee and Tea	-0.41** (0.14)	1.28** (0.29)
Orange Juice	-0.58** (0.16)	-0.15 (0.77)
Concentrated Milk	-0.78 (1.14)	1.91 (1.39)
	Group II	
Butter	-1.11** (0.38)	1.09** (0.04)
Margarine	-0.28 (0.56)	0.85** (0.06)
Cooking/Salad Oil	-1.34 (1.19)	1.03** (0.11)
Shortening	-0.27 (1.73)	0.85** (0.19)
	Group III	
Ice Cream	-0.62* (0.36)	1.46** (0.29)
Yogurt	-0.81 (0.55)	1.97** (0.32)
Cottage Cheese	-0.21 (0.54)	0.60* (0.31)
Cream	-0.51** (0.17)	0.52** (0.15)
	Group IV	
Cheddar Cheese	-0.66 (1.54)	1.12** (0.12)
Other Cheese	-1.22 (1.16)	1.11** (0.07)
Eggs	-0.33 (0.27)	0.92** (0.03)
Beef	-0.87** (0.40)	0.98** (0.04)
Pork	-0.75** (0.24)	1.01** (0.04)
Chicken	-0.69** (0.17)	0.93** (0.03)
	Single Equation	
Skim Milk Powder	-0.46 (2.16)	1.81 (1.14)

[1] Standard errors are shown in parentheses.

I. Introduction

The Canadian dairy industry faces a changing market environment as processors react to apparent shifts in consumers' preferences, consumers react to an altered mix of products on retail dairy shelves, and industry adjusts to potential pressures of competition and the challenge of new market opportunities under the impetus of changes arising from provisions of the Canada-U.S. Free Trade Agreement, the North American Free Trade Agreement and the General Agreement on Tariffs and Trade.

The major objective of this project is to apply the economic theory of consumer behaviour and demand in order to derive an updated and theoretically consistent set of own-price, cross-price and income elasticities for a disaggregated set of specified dairy products for which data are available. The purpose of the project is to provide a set of detailed and updated estimates of demand that may be incorporated in policy models by Agriculture and Agri-Food Canada (AAFC) and used for policy analysis and forecasting. Currently dairy demand estimates are only available for broad product groupings such as fluid milk, butter, all cheese and "all other dairy products" (Moschini and Moro, 1993; Ewing, 1994). The dairy products of interest for which parameter estimates are developed in this study include whole milk, low-fat milk, cheddar cheese, other (or specialty) cheese, butter, skim milk powder, ice cream, yogurt, concentrated milk and cottage cheese. As well, fluid cream was included in the analysis.

In this report, following this introduction, a brief overview of the model and related specification issues applied to derive the estimates of demand parameters is given. In the subsequent third section of the report, the underlying data, its sources, and some necessary adjustments of these data for purposes of demand estimation are outlined. An overview of consumption and price trends for the foods considered in the study is in the fourth section. Nonparametric analysis of dairy demand conducted to assess product groupings is reported in the fifth section. The results of the estimation of the price and expenditure elasticities based on parametric analysis that are the major purpose of the study are given in the sixth section of this report. A brief summary of major conclusions is in the seventh and final section. The data series used in the analysis are presented in an appendix.

II. The Model and Related Specification Issues

The almost ideal demand system of Deaton and Muellbauer (1980a), derived from the price independent generalized logarithmic expenditure function by Shephard's Lemma, expressed in budget share form is:

$$w_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \log p_j + \beta_i \log(\frac{X}{P}) \quad \textbf{(1)}$$

where in each period w_i and p_i are the expenditure share and price of the ith good in the system, X is the total expenditure on all n goods, and P is a price index defined by:

$$\log P = \alpha_0 + \sum_{j=1}^{n} \alpha_j \log p_j + \frac{1}{2} \sum_{i}^{n} \sum_{j}^{n} \gamma_{ij} \log p_i \log p_j. \quad \textbf{(2)}$$

The demand system expressed by (1) and (2) is a non-linear specification since logP is a quadratic function of $\log p_{j.}$ The linearized almost ideal demand system (LAIDS) is achieved by replacing logP by the linear approximation of Stones Price Index, logP*, where:

$$\log P^* = \sum_{k=1}^{n} w_k \log p_k. \quad \textbf{(3)}$$

This typically provides a good approximation of the original system and is relatively easily estimated. Following the suggestion of Eales and Unnevehr (1988), one period lagged expenditure shares are used for w_k in (3) to avoid problems of simultaneity. Since the Stone share-weighted price index is not invariant to changes in units of measurement of prices (Moschini, 1995), the commonly used procedure of normalizing the price series on their average value is applied.

To be consistent with the properties of demand theory, the parameters α_i, γ_{ij} and β_i should satisfy the following conditions:

(1) Adding up:

$$\sum_{i=1}^{n} \alpha_i = 1, \quad \sum_{i=1}^{n} \gamma_{ij} = 0, \quad \sum_{i=1}^{n} \beta_i = 0. \tag{4}$$

(2) Slutsky symmetry:

$$\gamma_{ij} = \gamma_{ji}. \tag{5}$$

(3) Homogeneity of degree zero in prices and income:

$$\sum_{j=1}^{n} \gamma_{ij} = 0. \tag{6}$$

Dynamic Specifications

The specification of Equation (1) assumes that parameters of the demand system are constant, implying a static demand pattern in which consumers fully adjust demand to a new equilibrium in each period of time in response to changes in prices and income in that time interval. This assumption is typically found to be unrealistic since consumers appear to form habits of consumption for certain foods or their tastes may change over time. In practice, provision for dynamic behaviour tends to be important in demand specification (Deaton and Muellbauer, 1980a, b; Pollak and Wales, 1992). Specifically, habit formation provisions that recognize that previous consumption affects preferences and consumption levels in the current period can be incorporated into the demand system, using the procedure of dynamic translation (Pollak and Wales, 1969), a procedure applied by Chen and Veeman (1991) for Canadian meat demand. A slightly different derivation leading to a similar estimating procedure was applied by Blanciforti *et al* (1986). Following this procedure, habit variables are introduced into the LAIDS model so that the coefficients α_i, which are interpreted as the basic budget share of the ith good in the system, are affected, while all the other coefficients remain unchanged. Alternative approaches to provide for dynamic consumer behaviour in this context could be based on the hypotheses of partial adjustment or adaptive expectations models, giving estimating models in which the lagged dependent variable is an argument (Gujarati, 1978). Finally, some authors have incorporated dynamism in consumer demand analyses by use of the first difference form of the estimating equation (for example, Eales and Unnevehr, 1988).

The incorporation of habit persistence variables into consumers' preference relationships and demand functions, through the concept of dynamic translating, was first proposed by Stone and extended by Pollak (1970) and others (Pollack and Wales, 1992). Pollak and Wales (1992) suggest several different habit formation specifications. We found three of these to be useful for this study. The simplest dynamic specification assumes that the dynamic translation parameter α_i follows a linear or log-linear trend with time t, that is:

$$\alpha_{it} = \alpha_i^* + \delta_i t. \qquad \textbf{(7)}$$

The time trend specification of (7) suffers from the limitation that it provides no information as to the sources of taste changes. An alternative specification, applied in effect by Blanciforti *et al* (1986), that was used by Chen and Veeman (1991) postulates that habit formation can be modelled as a linear or log-linear function of one-period lagged consumption:

$$\alpha_{it} = \alpha_i^* + \theta_i q_{i,t-1}. \qquad \textbf{(8)}$$

Another alternative hypothesis of habit behaviour is that α_i depends not only on past consumption of the good in question but also on previous consumption of other goods in the system, thus:

$$\alpha_{it} = \alpha_i^* + \theta_1 q_{1,t-1} + \cdots + \theta_i q_{i,t-1} + \cdots + \theta_n q_{n,t-1}. \qquad \textbf{(9)}$$

Since the third specification introduces n(n-1) more parameters into the original system, reducing the degrees of freedom, the concept of Equation (9) can be adapted to the simpler form of one-period lagged total expenditure on the n goods, X_{t-1}, to represent the overall dynamic effect of lagged consumption expenditures on α_i.

For each specification, quarterly seasonal dummy variables DM_2, DM_3, DM_4 are also added to account for seasonality in the quarterly data. The demand system incorporating habit formation modelled both as a time trend and as a single-period lagged consumption variable, as well as quarterly seasonality variables, is specified as:

$$w_{it}=\alpha_i^*+\delta_i t+\theta_i q_{i,t-1}+\sum_{j=1}^{n}\gamma_{ij}\log p_{jt}+\beta_i\log(\frac{X_t}{P_t^*})+\lambda_{i2}DM_{2t}+\lambda_{i3}DM_{3t}+\lambda_{i4}DM_{4t}+u_{it}. \quad \textbf{(10)}$$

In the model of Equation (10), the adding-up restriction implies that:

$$\sum_{i=1}^{n}\delta_i=0, \quad \sum_{i=1}^{n}\lambda_{i2}=0, \quad \sum_{i=1}^{n}\lambda_{i3}=0, \quad \sum_{i=1}^{n}\lambda_{i4}=0, \quad \sum_{i=1}^{n}\theta_i q_{i,t-1}=0. \quad \textbf{(11)}$$

Autocorrelation in the residuals can present a problem in econometric analyses that use time-series data. Sometimes we found that accounting for habit persistence, as with a lagged consumption habit variable, corrected this problem. A further approach to the problem of serial correlation is to apply the first difference version of LAIDS model, as suggested by Deaton and Muellbauer (1980a) and applied by Moschini and Moro (1993). We found it necessary to apply first differencing procedures for two dairy demand systems, fats and oils and cheeses and apparent substitutes. Equation (10) written in the first difference form is:

$$\Delta w_{it}=\delta_i+\theta_i\Delta q_{i,t-1}+\sum_{j=1}^{n}\gamma_{ij}\Delta\log p_{jt}+\beta_i\Delta\log(X_t/P_t^*)+\lambda_{i2}\Delta DM_{2t}+\lambda_{i3}\Delta DM_{3t}+\lambda_{i4}\Delta DM_{4t}+u_{it}-u_{i,t-1}. \quad \textbf{(12)}$$

Since Equation (12) is derived from (10), the previous restrictions on the parameters apply.

Own Price, Cross Price and Income Elasticities

Based on results of the LAIDS demand system estimation, the estimated coefficients are used to calculate Marshallian price elasticities and income elasticities for each commodity. The formulae that are most frequently used (Buse, 1994), outlined below, are applied for this purpose:

$$e_{ij}=\frac{\gamma_{ij}}{w_i}-\beta_i\frac{w_j}{w_i}-\delta_{ij},$$

$$\eta_i=\frac{\beta_i}{w_i}+1 \quad \textbf{(13)}$$

where e_{ij}, the uncompensated price elasticity, indicates the percentage change in the quantity demanded of good i with respect to one percent increase in the price of good j; the parameter δ_{ij}, the kronecker delta variable, is unity for the own-price case and zero for the cross-price case; and η_i, the expenditure elasticity, shows the percentage change in consumption of good i when total expenditure on the n goods is increased by one percent.

Separability Assumptions: Choice and Test of Product Groupings

A major objective of this study is to obtain demand parameters for the disaggregated list of dairy products outlined above; for some of these products, data on consumption and prices are only available for relatively short periods of time during recent years. Examples are yogurt and specialty cheese. For others, in particular the "traditional" dairy products such as cheddar cheese, butter and skim milk powder, information on prices and consumption is available for much longer periods of time. To fulfill the objective of estimation of a reliable set of demand parameters, based on the most complete set of available information, the dairy products in question, and other related food items, are grouped into several weakly separable groups, treating each of these as individual demand subsystems. This approach has the added benefit of flexibility in enabling the most appropriate means to be pursued for each subgroup in modelling habit formation or to remedy autocorrelation.

The study involves four groups of related products. These are:

1. Milk and other beverages
2. Fats and oils group
3. Dairy dessert products
4. Cheeses and apparent substitutes.

The components of Group 1, Milk and other beverages, are whole milk, low-fat milk, orange juice, soft drinks, tea and coffee, and concentrated milk. The components of Group 2, the Fats and oils group, are butter, margarine, cooking/salad oil, and shortening. Components of Group 3, Dairy dessert products, include ice cream, yogurt, cottage cheese and cream. The components of Group 4, Cheeses and apparent substitutes include cheddar cheese, other cheese (representing primarily mozzarella cheese), eggs, beef, pork, and chicken. Skim milk powder was not a member of any of the groups outlined above and was therefore treated separately.

We followed a two-stage process to arrive at these product groupings. The first of these involved application of the theory of revealed preference to specific product groupings, chosen initially on the basis of *a priori* considerations. The consistency of consumer choice within each postulated commodity group was tested, using non-parametric procedures. In this assessment the procedure used by Chalfant and Alston (1988) was applied to assess whether the aggregate data for each grouping are consistent with the weak axiom of revealed preference (WARP). The statistical test of Tsur (1989) was also applied to test for significant violations of the generalized axiom of revealed preference (GARP). For the product groupings reported here there is no evidence of significant violations of the axioms of revealed preference. Thus, the results of these tests, which are outlined in detail in Section V of this paper, give a general indication that the product groupings outlined here are appropriate.

The second stage of assessment of appropriateness of each of the suggested product combinations as a weakly separable group was to judge the reasonableness of estimated demand parameters, expressed as elasticity estimates, in terms of expectations based on economic theory, *a priori* beliefs or evidence from other studies. All the product groupings outlined above passed these tests. One product, skim milk powder, failed the two-stage test and is analysed separately.

III. Data Sources, Problems and Processing Procedures

Demand system estimation requires per capita consumption and retail price data for each of the commodities in the system. The commodities, the sources of data for them, and the time period for which each data series is available are listed in Table 1. Most of the per capita disappearance and consumer price index series are supplied by AAFC based on the allocation to quarterly periods of the annual disappearance data collected and reported by Statistics Canada. Other data series are collected from CANSIM and other sources. All the data series are for quarterly periods.

Table 1: Data List, Sources and Time Periods

Per Capita Disappearance		Commodity	Consumer Price Index	
Source	Time Period		Source	Time Period
AAFC	1965Q1-1994Q1	1. Whole Milk	AAFC	1978Q3-1994Q2
AAFC	1966Q1-1994Q1	2. Low-Fat Milk = 2% Milk + Skim Milk + Butter Milk + Chocolate Milk + 1% Milk	AAFC[1]	1979Q1-1994Q2
CANSIM	1977Q1-1994Q1	3. Fluid Cream = Cereal Cream + Table Cream + Whipping Cream + Sour Cream	CANSIM[2]	1965Q1-1994Q1
AAFC	1966Q1-1993Q4	4. Butter	AAFC	1965Q1-1994Q2
AAFC	1966Q1-1994Q1	5. Cheddar Cheese[3]	AAFC	1965Q1-1994Q2
AAFC	1966Q1-1994Q1	6. Other Cheese	Statistics Canada[4]	1984Q4-1994Q2
AAFC	1976Q1-1993Q4	7. Skim Milk Powder	AAFC	1965Q1-1994Q2
AAFC	1977Q1-1993Q4	8. Ice Cream	AAFC	1967Q1-1994Q2
AAFC	1966Q1-1993Q4	9. Yogurt	Statistics Canada	1984Q4-1994Q2
AAFC	1979Q1-1993Q4	10. Evaporated/Concentrated Milk	AAFC	1965Q1-1994Q2
AAFC	1965Q1-1993Q4	11. Cottage Cheese	AAFC	1978Q3-1994Q2
AAFC	1979Q1-1994Q1	12. Soft Drink	CANSIM	1965Q1-1994Q1
AAFC	1979Q1-1994Q1	13. Orange Juice Concentrated	CANSIM	1979Q1-1994Q1
AAFC	1979Q1-1994Q1	14. Orange Juice Except Concentrated	CANSIM	1979Q1-1994Q1
AAFC	1979Q1-1994Q1	15. Coffee and Tea	CANSIM	1971Q1-1994Q1
AAFC	1972Q1-1993Q4	16. Eggs	CANSIM	1965Q1-1994Q1
AAFC	1979Q1-1993Q4	17. Beef	CANSIM	1978Q3-1994Q1
AAFC	1979Q1-1993Q4	18. Pork	CANSIM	1978Q3-1994Q1
AAFC	1979Q1-1993Q4	19. Chicken	CANSIM	1978Q3-1994Q1
Oils and Fats[5]	1979Q1-1994Q1	20. Margarine	AAFC	1965Q1-1994Q1
Oils and Fats	1978Q1-1994Q1	21. Shortening	CANSIM[6]	1965Q1-1994Q1
Oils and Fats	1978Q1-1994Q1	22. Cooking/Salad Oil	CANSIM	1973Q2-1994Q1

CANSIM	1979Q1-1993Q4	23. Current and Constant Expenditure on Food Including Non-Alcoholic Beverages[7]	CANSIM	1979Q1-1993Q4

[1] Consumer price index (CPI) for low-fat milk is not available; the CPI for 2% milk is used.
[2] Since no CPI series for fluid cream is available, the industrial price index (IPI) is used as the relevant price index.
[3] Includes processed cheese.
[4] This price series is for "other cheese"; it was directly supplied by the Prices Division of Statistics Canada and is believed to represent primarily mozzarella cheese.
[5] *Oils and Fats* is the monthly publication by Statistics Canada, Catalog number 32-006. The consumption series for margarine, shortening and cooking/salad oil are manufacturer's packaged retail sales. An alternative series of packaged sales of margarine was available from AAFC; as discussed in the text, that series, which consists of both retail and commercial sales, is not used in the study.
[6] The CPI for shortening was terminated in Dec., 1988. The IPI for this commodity is used as a proxy for the retail price index series for the period 1989Q1 to 1994Q1.
[7] The CPI for food and non-alcoholic beverages (1986=100) is derived by dividing current dollar expenditure on this group of commodities by constant dollar expenditure on the group and multiplying by 100.

Converting Consumer Price Indexes to Nominal Prices

The analysis requires calculations of commodity expenditures, based on quantity and retail price series for each commodity. For this purpose, additional information is used to convert the consumer price indexes to nominal prices. Demand researchers have developed two kinds of methods to convert consumer price indexes to the nominal price series required to generate expenditure shares. The first of these uses city average retail prices from Statistics Canada, *Consumer Prices and Price Indexes*. The nominal prices are derived by multiplying the consumer price index series by the corresponding city average retail prices for a recent base year, applying weights based on consumers' expenditures developed by Statistics Canada for the consumer price index. This procedure was used by Reynolds and Goddard (1991) and Chen and Veeman (1991). The method is not suitable for this study, because data for city average retail prices are not available for all 11 of the dairy products and 10 substitutes that are considered in this study. Data on only nine of these are reported in *Consumer Prices and Price Indexes*.

In this study, the alternative method applied by Moschini and Vissa (1993) is applied based on data from the periodic Family Food Expenditure survey (Statistics Canada, *Family Food Expenditure in*

Canada). This survey provides periodic detailed average weekly data on quantities purchased and expenditures on food by Canadian families. Data are available for all the commodities in question for the years 1969, 1974, 1976, 1978, 1982, 1984, 1986, 1990 and 1992. For each item, nominal price is computed as the ratio of average weekly expenditures and the average weekly quantities consumed per household as reported in each survey year. The prices derived by this process are given in Table 2. To develop full series of the relevant prices, consumer price indexes are converted from quarterly to annual data for corresponding years. By regressing the nominal price data in Table 2 through the origin on the respective annual consumer price indexes, and multiplying the quarterly consumer price indexes by the estimated coefficient, estimates of quarterly prices are produced for the entire sample period. The estimated coefficients, enlarged one hundred times to reflect the retail price level of the products, their price units, as well as the t-values and R^2 of the regressions, are reported in Table 3.

Conversion of Price Units for Consistency with Per Capita Disappearance Series

The estimated coefficients in column 2 of Table 3 represent the 1986 average retail price levels for the listed food items. The units are those of the Family Food Expenditure Survey; some of these differ from the unit of measurement of the data series on per capita disappearances. This is the case, for example, for ice cream, yogurt, concentrated milk, orange juice, and cooking/salad oil for which quantities are measured in kilograms, but prices are expressed per litre. These price series are converted to be consistent with the consumption units. The densities used for the conversion are 1.1kg/L for ice cream, [1] 1.06763 kg/L for yogurt, 1.07kg/L for concentrated milk, 1kg/L for orange juice and 0.93kg/L for cooking/salad oil, respectively.

[1] Ice cream disappearance is determined in terms of ice cream mix which has a higher density than ‘finished’ ice cream, for which density approximates 0.56 kg/litre.

Table 2: Commodity Prices from Family Food Expenditure Survey*

	$/unit	1969	1974	1976	1978	1982	1984	1986	1990	1992
whole milk	litre	0.264	0.351	0.47	0.542	0.823	0.875	0.941	1.008	1.049
low-fat milk	litre	0.246	0.336	0.45	0.507	0.768	0.825	0.852	0.954	0.973
cream	litre	0.924	1.165	1.47	1.722	2.429	2.676	2.877	3.333	3.452
yogurt	litre		1.49	1.87	1.942	2.941	3.136	3.261	3.724	3.481
butter	kg	1.544	1.874	2.55	2.973	4.725	5.256	5.380	5.816	5.630
cheddar cheese	kg	1.762	1.835	2.81	3.598	4.298	7.708	8.509	9.432	9.262
cottage cheese	kg	0.801	1.41	1.84	2.131	3.281	3.585	3.600	4.182	4.186
other cheese	kg	2.118	3.298	4.39	5.168	7.255	8.019	8.818	9.542	9.433
skim milk powder	kg	0.862	1.308	1.46	2	4.706	4.546	5.556	6.667	6.000
concentrated milk	litre	0.448	0.71	0.9	1.091	1.944	2.239	2.157	2.826	2.727
ice cream	litre	0.463	0.649	0.88	0.955	1.297	1.365	1.458	1.626	1.542
beef	kg	1.81	2.96	2.91	3.96	4.98	5.73	5.310	6.955	6.602
pork	kg	1.66	2.48	3.04	3.51	4.16	4.33	4.920	5.772	5.327
chicken	kg	1.139	1.819	2.04	2.44	2.942	3.179	3.161	3.828	3.929
eggs	dozen	0.584	0.765	0.91	0.946	1.247	1.338	1.315	1.489	1.435
coffee & tea	kg	3.914	5.048			11.82	12.46	14.062	14.457	9.829
margarine	kg	0.591	1.231	1.42	1.765	1.93	2.227	2.093	2.571	2.414
shortening	kg	0.786	1.468	1.57	1.538	2.188	2.353	2.692	3.000	2.632
cooking/salad oil	litre				1.752	2.16	2.357	2.358	2.308	2.348
orange juice except concentrated	litre	0.438	0.537	0.65	0.788	1.173	1.264	1.315	1.577	1.485
orange juice concentrated	litre		1.296	1.42	2.2	2.622	2.931	2.766	3.098	2.750
soft drink	litre	0.405	0.503	0.73	0.631	0.942	1.018	1.174	1.048	1.026

*Note: The average price for each commodity from Family Food Expenditure Survey is calculated by dividing its average weekly expenditure per household by the corresponding average weekly quantities consumed per household for the survey year. Some commodities, such as low-fat milk, beef, pork, coffee & tea, and soft drink,amongst others, are aggregated over more detailed items. Their prices are weighted averages for which the expenditure shares of the disaggregated items are the weights; for beef and pork, the weighted aggregates for 1969 to 1986 are as calculated and reported by Moschini and Moro (1993).

Table 3: Estimated Results of Regressing Nominal Prices on the Corresponding Consumer Price Indexes

Food Items & Price Units	Estimated Coefficients	t-ratio	R^2
whole milk (L)	0.9292	62.36	0.9634
low-fat milk (L)	0.8481	99.78	0.9857
butter (kg)	5.4073	93.15	0.9935
cheddar cheese (kg)	7.7702	21.53	0.9282
other cheese (kg)	8.2651	39.02	0.5685
ice cream (L)	1.4939	29.07	0.9112
yogurt (L)	3.1875	53.52	0.7583
cottage cheese (kg)	3.7564	53.95	0.9546
skim milk powder (kg)	5.4046	36.27	0.976
concentrated milk (L)	2.2942	58.04	0.9884
cream (L)	2.9077	46.47	0.968
beef (kg)	5.829	36.87	0.9349
pork (kg)	5.0183	99.97	0.9805
chicken (kg)	3.2936	29.59	0.8628
eggs (doz)	1.3285	126.2	0.9927
orange juice (L)[1]	1.366	62.4	0.9116
concentrated org. juice (L)[1]	2.5883	29.82	0.9955
coffee & tea (kg)	15.038	21.06	0.4854
margarine (kg)	2.2044	51.81	0.9697
shortening (kg)	2.7863	32.8	0.9443
cooking/salad oil (L)	2.4103	27.91	0.3341
non-alcoholic drinks (L)	1.1279	26.04	0.8649

[1] Consumption and consumer price index series for two kinds of orange juices were available: concentrated orange juice and orange juice except concentrated. To derive the price for orange juice, each of these two consumer price indexes were first converted into nominal prices; their weighted nominal price was then calculated, using consumption for each of the two categories at every sample point as weights.

Conversion of Carcass-Weights to Retail-Weights for Beef and Pork

The consumption data for beef and pork are reported on a carcass-weight basis which includes the hide or skin, bone and fat that are removed before retail sale of beef and pork. The factors suggested by Hewston (1987) and Hewston and Rosien (1989) are used to convert beef and pork consumption from carcass to retail weights. These factors have tended to decline over time, reflecting the trend toward leaner carcass. They are listed in Table 4.

Table 4: Factors to Convert Carcass Weight Data to Retail Weights

Beef		Pork	
Period	Factor	Period	Factor
1972-1978	0.76	1970-1975	0.78
1979-1985	0.74	1976-1982	0.77
1986 to date	0.73	1983 to date	0.76

IV. Consumption and Price Trends

The series of quarterly data for per capita disappearance and prices, derived as discussed above, are depicted graphically in this section of the report. For commodities in Group 1, milk and related beverages , these series are in Figures 1 to 6. These show the trend toward declining consumption of whole milk and concentrated milk; the increasing consumption of low-fat milk and soft drinks; and the considerable variability, rather than an obvious trend, in the consumption of orange juice and coffee and tea.

Per capita consumption and price trends for the fats and oils group are shown in Figures 7 to 10 which depict the tendency for consumption of most items in this group to decline. Consumption and price trends of dairy dessert products are depicted in Figures 11 to 14. A slight declining trend and considerable seasonality are evident for ice cream consumption per capita. Yogurt consumption tended to increase from the earlier 1980s to 1989, and has subsequently moderated. Cottage cheese consumption has tended to fall since the early 1980s, while cream consumption has tended to fluctuate around a relatively stable level

Figure 1: Quarterly Per Capita Disappearance and Retail Price for Whole Milk

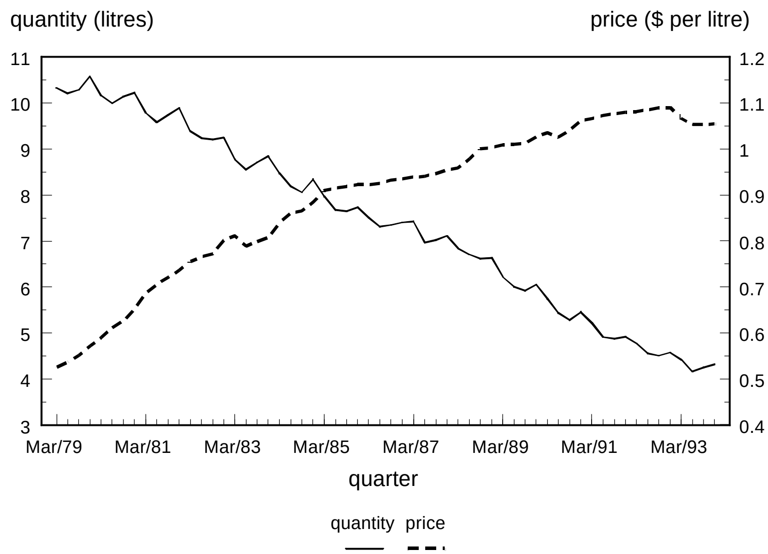


Figure 2: Quarterly Per Capita Disappearance and Retail Price for Low Fat Milk

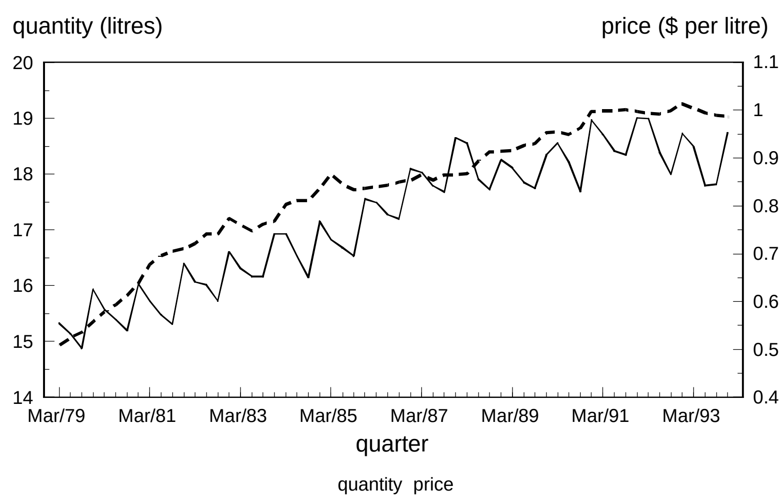


Figure 3: Quarterly Per Capita Disappearance and Retail Price for Soft Drink

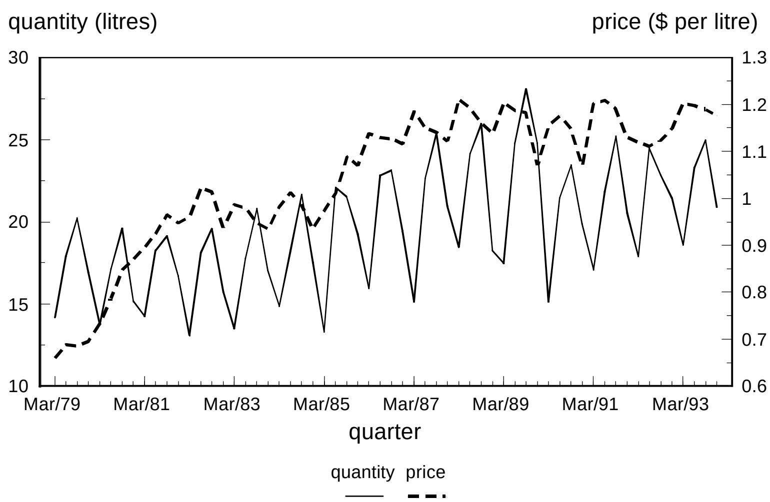


Figure 4: Quarterly Per Capita Disappearance and Retail Price for Orange Juice

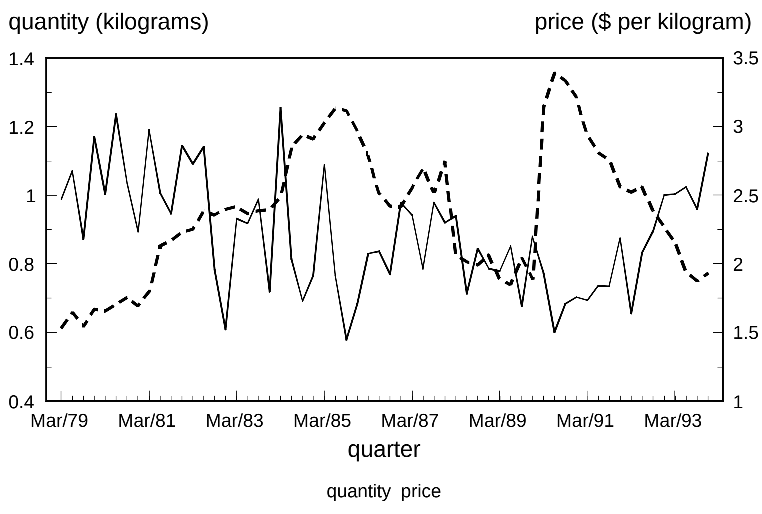


Figure 5: Quarterly Per Capita Disappearance and Retail Price for Coffee and Tea

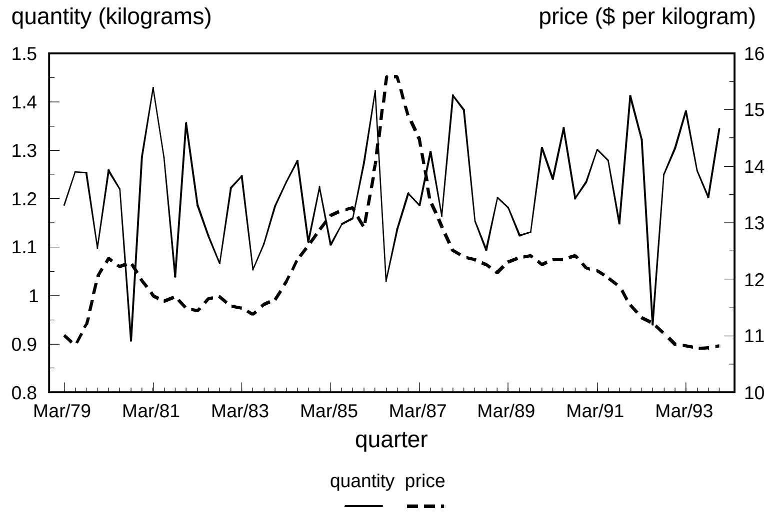


Figure 6: Quarterly Per Capita Disappearance and Retail Price for Concentrated Milk

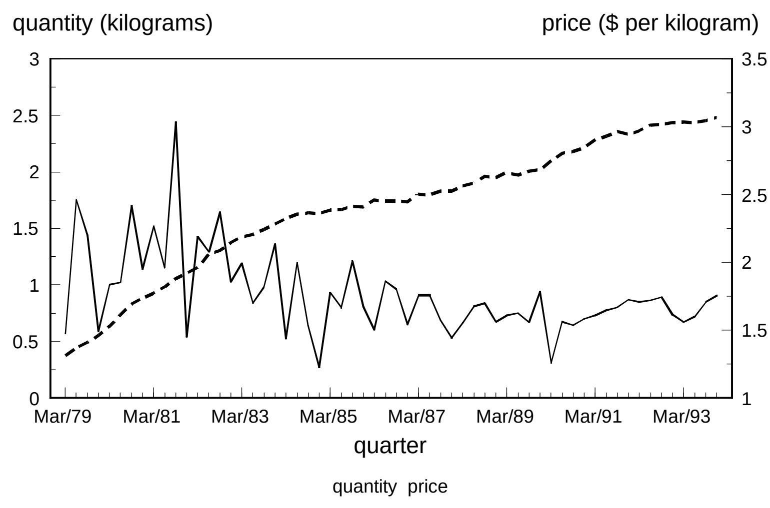


Figure 7: Quarterly Per Capita Disappearance and Retail Price for Butter

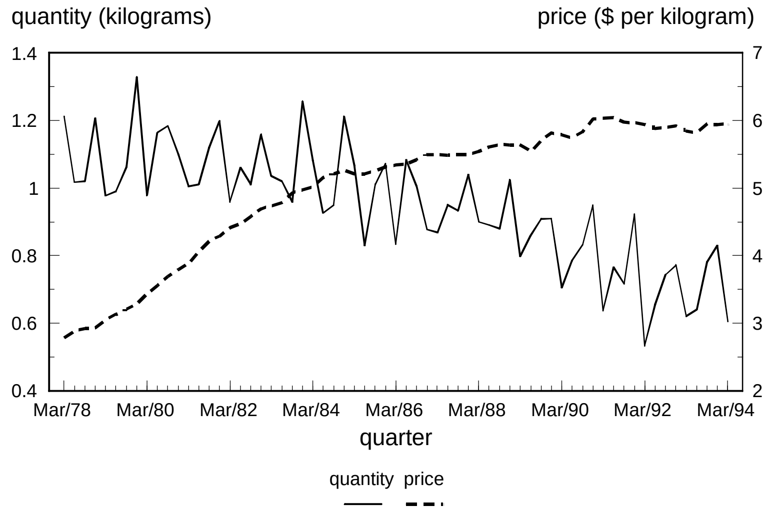


Figure 8: Quarterly Per Capita Disappearance and Retail Price for Margarine

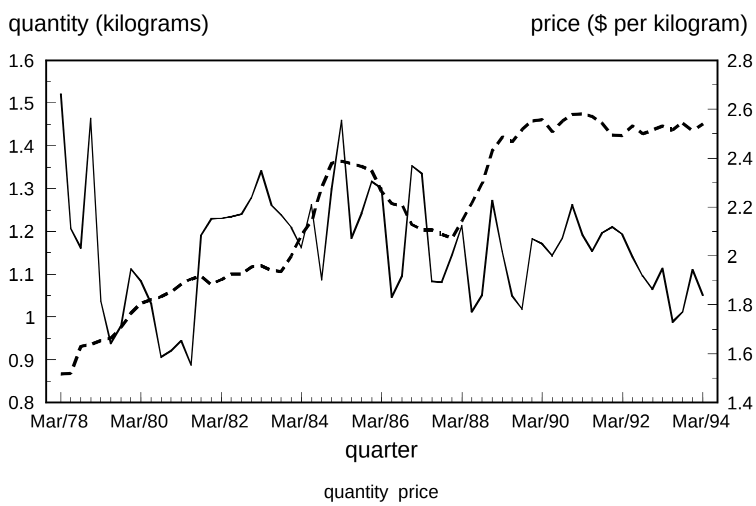


Figure 9: Quarterly Per Capita Disappearance and Retail Price for Shortening

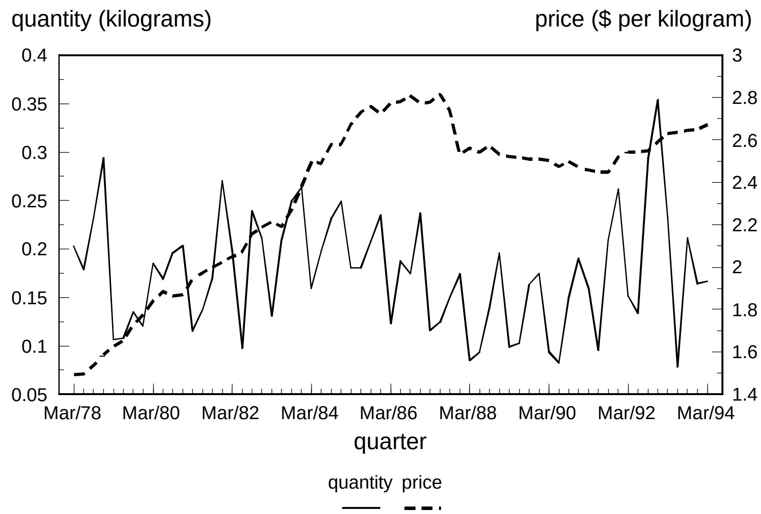


Figure 10: Quarterly Per Capita Disappearance and Retail Price for Cooking/Salad Oil

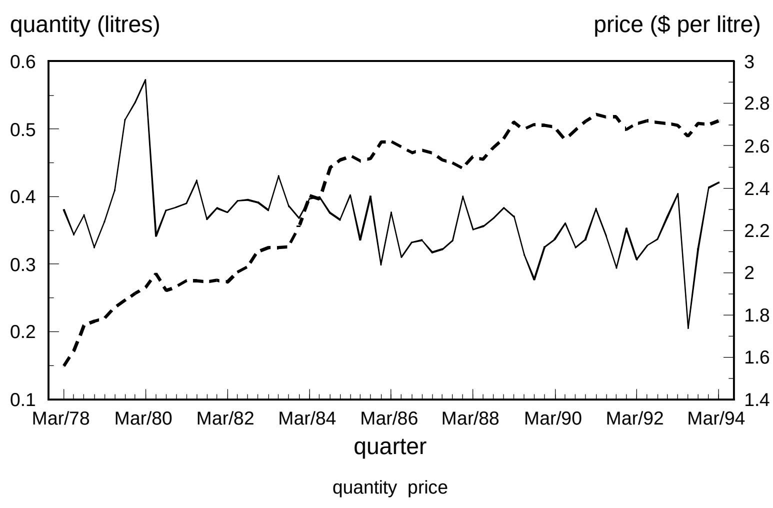


Figure 11: Quarterly Per Capita Disappearance and Retail Price for Ice Cream

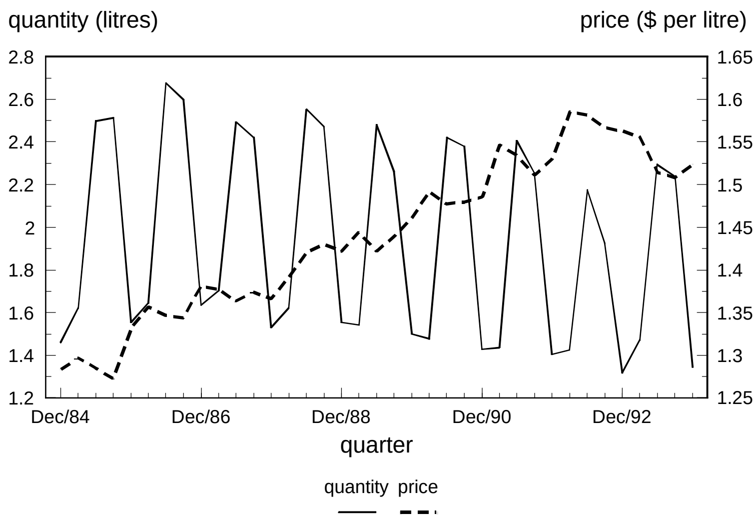


Figure 12: Quarterly Per Capita Disappearance and Retail Price for Yogurt

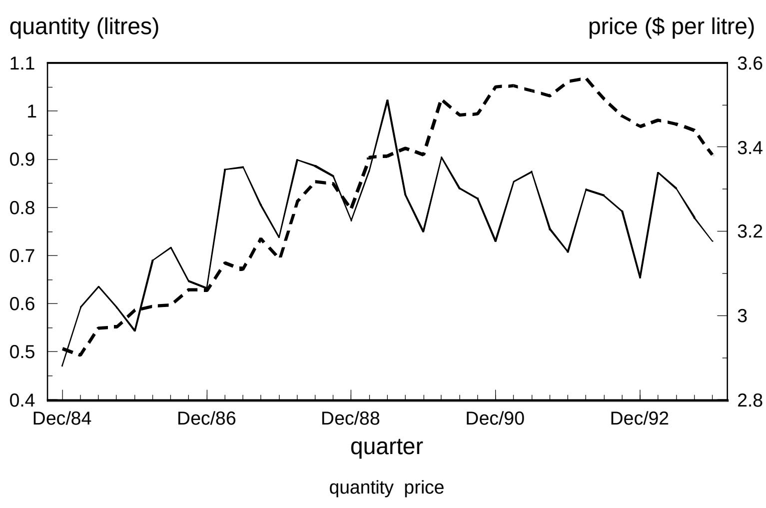


Figure 13: Quarterly Per Capita Disappearance and Retail Price for Cottage Cheese

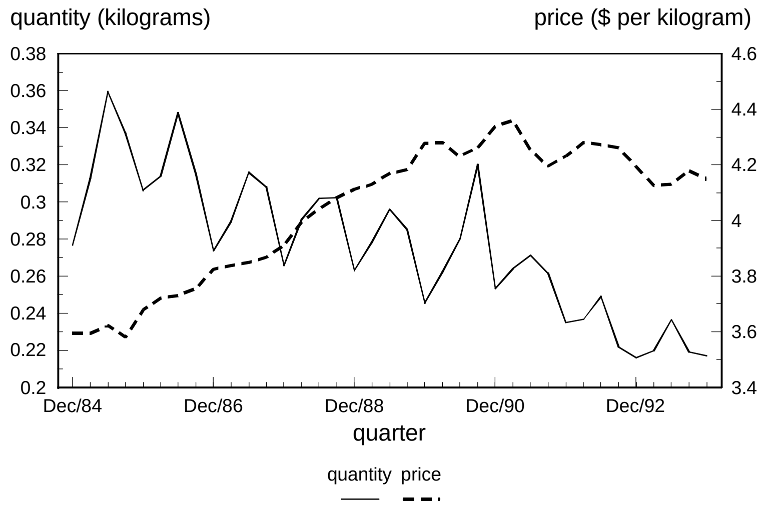


Figure 14: Quarterly Per Capita Disappearance and Retail Price for Cream

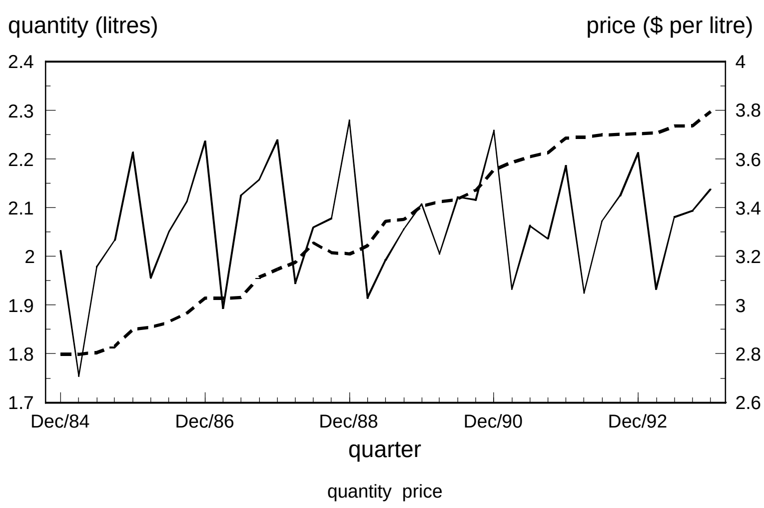


Figure 15: Quarterly Per Capita Disappearance and Retail Price for Cheddar Cheese

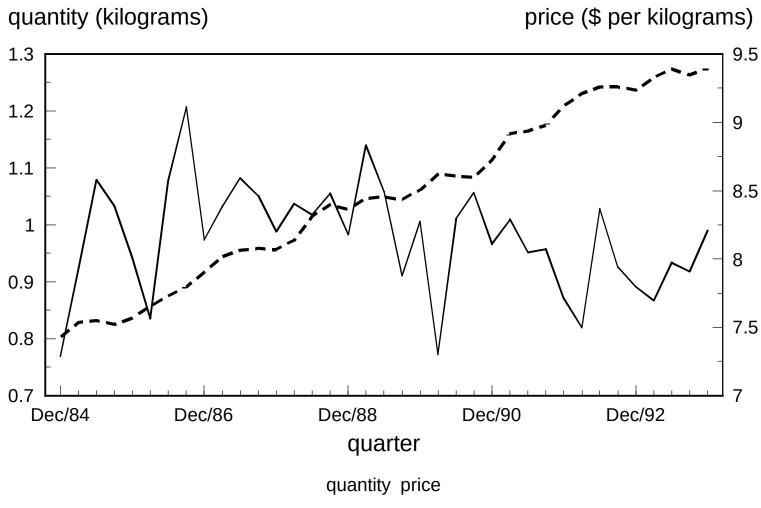


Figure 16: Quarterly Per Capita Disappearance and Retail Price for Other Cheese

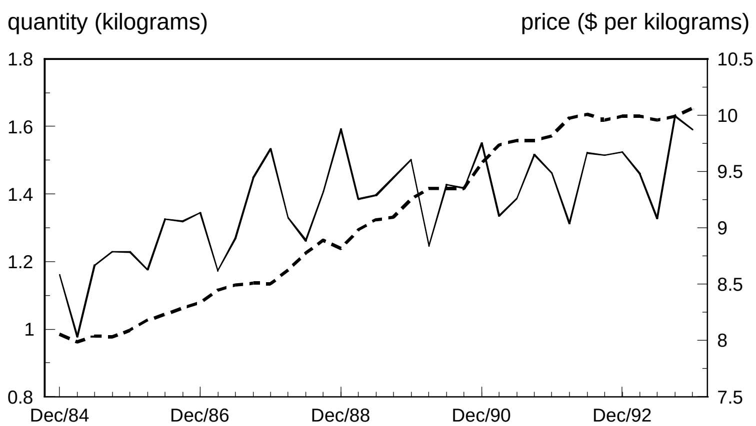


Figure 17: Quarterly Per Capita Disappearance and Retail Price for Eggs

Figure 18: Quarterly Per Capita Disappearance and Retail Price for Beef

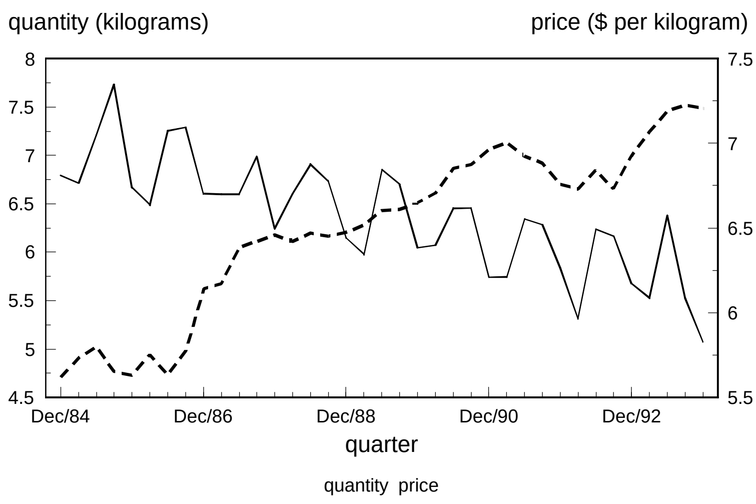


Figure 19: Quarterly Per Capita Disappearance and Retail Price for Pork

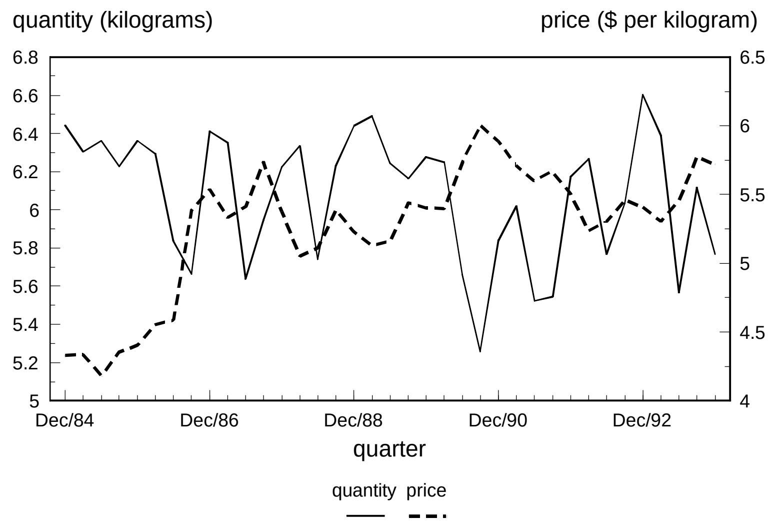
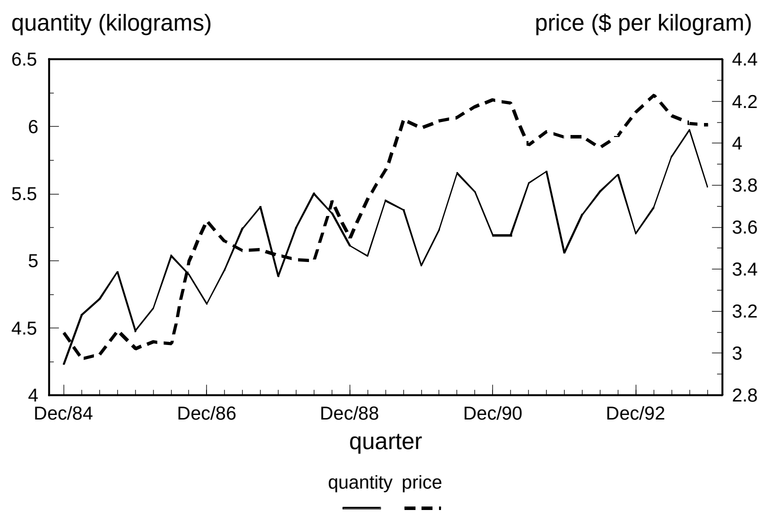


Figure 20: Per Capita Disappearance and Retail Price for Chicken



since the mid-1980s.

Consumption and price trends of items in the final group, cheese and apparent substitutes, are graphed in Figures 15 to 20. Per capita cheddar cheese consumption has tended to decline slightly over the past decade while other cheese consumption has increased. Consumption per capita of the major protein substitute products of eggs and beef have tended to decline, pork has tended to fluctuate in consumption, and chicken consumption has trended upward.

V. Non-parametric Analysis of Dairy Demand

The theory of revealed preference characterizes consumer choice behaviour based on utility or preference maximization. First proposed by Samuelson (1938a, b) this body of economic theory postulates that the individual consumer chooses a bundle of goods which is preferred to all other bundles that are affordable. Tests of the consistency of preferences based on this approach apply non-parametric methods. In contrast to parametric approaches to analyse demand, the theory of revealed preference can be used to study consumer behaviour and to test consistency of consumption patterns, without specifying the form of demand functions. However, to obtain elasticity parameters, a parametric approach involving hypothesized functional forms is required for estimation.

Following revealed preference theory, a consumption bundle a is defined to be directly revealed preferred to a different bundle b if a is chosen when b, which is affordable, could have been chosen. This relationship is denoted by aR^0b. Based on this definition, the Weak Axiom of Revealed Preference (WARP), specifies that:

$$aR^0b \text{ implies not } bR^0a. \tag{14}$$

That is, WARP postulates that if bundle a is directly revealed preferred to b, then b can not be directly revealed preferred to a. Thus WARP is violated if any bundle, such as b, is also directly revealed preferred to a. This violation applies, for example, if a lies inside the budget line associated with b, and b lies inside the budget line of a.

The violation of WARP implies that consumer's behaviour is not consistent with utility maximization, which may be the result of improper assumptions regarding weak separability and commodity grouping. Alternatively, violation of WARP could be indicative of a structural change in the consumer's demand pattern such as may be the consequence of shifts of indifference curves.

Following procedures developed by Varian (1982, 1983), Chalfant and Alston (1988) applied the theory of revealed preference to test for the violation of the WARP in order to assess whether structural change may have occurred in the demand for red meat. To assess the appropriateness of the product groupings of dairy products postulated in this study we first apply Chalfant and Alston's procedure, summarized below, and then proceed to apply a test of the Generalized Axiom of Revealed Preference (GARP). The latter is discussed in more detail in the subsequent section.

At time t, assuming P_a and Q_a are the vectors of the price and per capita consumption of bundle a, where $P_a' = (p_{t1}, p_{t2}, ..., p_{tN})$, $Q_a' = (q_{t1}, q_{t2}, ..., q_{tN})$, and N denotes the number of goods, the cost of purchasing bundle a is $P_a' \cdot Q_a$. Define the expenditure matrix Φ by:

$$\Phi = (P_a' \cdot Q_b)_{nxn} = \begin{bmatrix} p_{11}, p_{12}, ..., p_{1N} \\ p_{21}, p_{22}, ..., p_{2N} \\ ... \\ p_{n1}, p_{n2}, ..., p_{nN} \end{bmatrix} \begin{bmatrix} q_{11}, q_{21}, ..., q_{n1} \\ q_{12}, q_{22}, ..., q_{n2} \\ ... \\ q_{1N}, q_{2N}, ..., q_{nN} \end{bmatrix}, \quad \text{where } t = 1, ..., n \text{ denotes time periods.}$$

Each element in $P_a' Q_b$ is the cost of purchasing bundle a, evaluated at the different sets of prices that applied when specific bundles were purchased (i.e. at time b). The elements in each column of Φ give the cost of obtaining the consumption bundle b at various price vectors, and the elements in each row give the costs of the various bundles at a particular set of prices. By the theory of revealed preference, aR^0b implies that the actual expenditure at time a exceeds the cost of bundle b at time a prices, so that $\Phi_{aa} > \Phi_{ab}$. The WARP is violated if $\Phi_{aa} > \Phi_{ab}$, and $\Phi_{bb} > \Phi_{ba}$ both apply. The violation of the WARP indicates inconsistencies in consumer's preferences.

Test Results of WARP

Taking Group 1 as an example, Φ, in this case, is a 60x60 matrix. This is used to form a matrix of quantity indexes Ψ by dividing every element by the diagonal element in the same row, i.e. $\Psi_{ij} = \Phi_{ij} / \Phi_{ii}$. If $\Phi_{ij} / \Phi_{ii} < 1$, the bundle of quantities bought at time j was affordable at the prices that applied in time period i, i.e. iR^0j. If both $\Phi_{ij} / \Phi_{ii} < 1$ and $\Phi_{ji} / \Phi_{jj} < 1$ apply, this indicates violation of the WARP. The degree of violation can be judged by the size of the index. Table 5 shows the pairs of data points in Ψ found to be in violation of the WARP for each of the four groups of dairy products.

Table 5: WARP Violating Pairs

Group 1: whole milk, low-fat milk, soft drink, orange juice, coffee & tea, concentrated milk
Period: 1979Q1-1993Q4, n=60.
Number of Violations: 9 out of 1770; Specific violations are:

i	j	Ψ(i,j)	Ψ(j,i)
3:1979Q3	42:1989Q2	0.99797	0.99451
5:1980Q1	18:1983Q2	0.98666	0.99584
6:1980Q2	14:1982Q2	0.99540	0.99812
6:1980Q2	15:1982Q3	0.99975	0.99030
6:1980Q2	54:1992Q2	0.99759	0.99093
9:1981Q1	15:1982Q3	0.99244	0.99981
12:1981Q4	54:1992Q2	0.99995	0.99475
22:1984Q2	54:1992Q2	0.99660	0.99853
32:1986Q4	54:1992Q2	0.99039	0.99924

Group 2: butter, margarine, shortening, cooking/salad oil.
Period: 1978Q1-1994Q1, n=65.
Number of Violations: 3 out of 2080; Specific violations are:

i	j	Ψ(i,j)	Ψ(j,i)
5:1979Q1	13:1981Q1	0.99891	0.99950
33:1988Q1	38:1989Q2	0.99929	0.99429
33:1988Q1	41:1990Q1	0.99869	0.99744

Group 3: ice cream, yogurt, cottage cheese, cream.
Period: 1984Q4-1993Q4, n=37.
Number of Violations: 4 out of 666; Specific violations are:

i	j	Ψ(i,j)	Ψ(j,i)
7:1986Q2	23:1990Q2	0.99863	0.99959
7:1986Q2	24:1990Q3	0.99940	0.99875
18:1989Q1	29:1991Q4	0.99431	0.99992
26:1991Q1	37:1993Q4	0.99618	0.99824

Group 4: cheddar cheese, other cheese, eggs, beef, pork, chicken.
Period: 1984Q4-1993Q4, n=37.
Number of Violations: 5 out of 666; Specific violations are:

i	j	Ψ(i,j)	Ψ(j,i)
10:1987Q1	32:1992Q3	0.99958	0.99693
11:1987Q2	28:1991Q3	0.99849	0.99955
13:1987Q4	32:1992Q3	0.99863	0.99944
18:1989Q1	31:1992Q2	0.99950	0.99950
33:1992Q4	35:1993Q2	0.99943	0.99939

Chalfant and Alston did not apply statistical tests to assess the significance of such violations. Instead, the numbers of violating pairs were compared with the total numbers of commodity pairs. The extent of deviation of the quantity indexes from unity in the violating pairs was used to indicate the severity of the violations.

For the dairy product groupings of this study, there are a very small number of violating pairs; the violating index numbers range from 0.98666 to 0.99992. Similar to Chalfant and Alston's test results for red meats, calculations for each of the four groups of dairy products indicate that rejection of the WARP is not very severe.

It is possible that such a lack of violation of the revealed preference axiom may occur if the budget lines have shifted upward over time and thus rarely cross because of this factor. If this is the case, real expenditures will have risen through time. Then at any time i, the cost of bundle j (j < i) at the prices in time i would be cheaper than the actual cost at i, and the cost of bundle j (j > i) at the prices holding in time i would be greater. This can be expressed as: $\Phi_{ij} < \Phi_{ii}$ (j < i), and $\Phi_{ij} > \Phi_{ii}$ (j > i). The extreme case would occur for matrix Ψ if all elements above the diagonal were to exceed unity and all elements below the diagonal were to be less than one.

Following Chalfant and Alston we check the numbers of elements both below and above the diagonal in Ψ that are less than one. If there are many instances where this is the case below the diagonal and few instances above the diagonal, it is likely that the real expenditures have grown and that the budget lines have moved outward during the period. If this has been the case, the conclusion of few violations may be spurious. Table 6 lists the number of times out of the total in which $\Psi(i,j)<1$ (i>j) and $\Psi(i,j)<1$ (i<j) for each of the four groups of dairy products.

Table 6: Test of Expenditure Changes Over Time

Group	$\Psi(i,j)<1$ (i>j)	$\Psi(i,j)<1$ (i<j)
1	1017 / 1770	633 / 1770
2	459 / 2080	1538 / 2080
3	277 / 666	357 / 666
4	194 / 666	435 / 666

In Group 1, there are 633 out of 1770 elements above the diagonal and 1017 out of 1770 below the diagonal which are less than one. This implies that 36% (633/1770) of the observed bundles were affordable at the prices observed earlier while 43% ((1770-1017)/1770) of the observed bundles were not affordable at later price levels. Since, on average, 40% of the data are not consistent with the hypothesis that budget lines have consistently moved outward over time, it does not appear that this potential explanation of the lack of WARP violations has applied for milk and other beverages. The similar percentages are even higher for the other three groups, at 77%, 63% and 69%, respectively for Groups 2 to 4. It can therefore be concluded that outward shifting of budget lines is not a factor affecting the nonrejection of the Weak Axiom of Revealed Preference in this study.

Test Results of GARP

Evidence of non-violation of the WARP is not sufficient to infer that the conditions for utility maximization hold. The Generalized Axiom of Revealed Preference (GARP) is the necessary and sufficient condition for the existence of a non-satiated utility function that rationalizes the data (Varian, 1982, 1983). The GARP is defined as:

$$aRb \ \ implies \ \ not \ \ bP^{0}a, \qquad \textbf{(15)}$$

where aRb is defined as bundle a revealed preferred to b, or that there is a sequence of bundles $a^1, a^2, ..., a^k$, such that $aR^0a^1, a^1R^0a^2, ..., a^kR^0b$ and where $bP^0{}_a$ is defined as b strictly directly revealed preferred to a (Varian, 1982).

Tsur (1989) proposes a procedure to test for the significance of the violation of the GARP. In the case that GARP is volated, this test takes the measurement errors that may exist in the observed data into consideration to check if the violation in the observed data is caused by the measurement error. Following Tsur's algorithm, FORTRAN programming was applied for the following procedures:

1) Search for the perturbation vector e^t : The first step in this procedure is to create a matrix which represents the transitive closure of the direct revealed preference relationships of the expenditure matrix Φ and check for any violations of GARP following Varian's (1982) algorithm. If violations are found, the approach involves consideration of measurement error necessary for the data to satisfy GARP. Thus, when violations are found, the next step is to calculate the perturbation vector $e^t = (e^1, e^2, ... e^n)$ so that the extent of perturbed expenditure to satisfy GARP is calculated. Up to n iterations of these two steps may be required to calculate a perturbation vector e^t for which the perturbed data set satisfy GARP. In practice, relatively few iterations are typically required.

2) Calculate Tsur's index: $$\hat{\rho} = \sum_{t=1}^{n} \frac{[\log e^{t}]^2}{n} \qquad \textbf{(16)}$$

   This represents the distance between the perturbed expenditure vector and the observed expenditure vector (the diagonal elements of Φ). Assuming that $\epsilon_j \sim_{iid} N(0,\sigma^2), j=1,...n,$ is the measurement error, $S_n^2 = \sum_{j=1}^{n} \epsilon_j^2/n$ is the distance between the actual and observed expenditure vector and is distributed as the Chi-square statistic: $(\sigma^2/n)x_n^2$. Tsur's index $\hat{\rho}$ is then compared with S_n^2. Under the null hypothesis of no violation of GARP, $\hat{\rho} \leq S_n^2$.

3) Calculate $\bar{\sigma}^2 = n\ \hat{\rho}/x_n^2(\alpha)$ **(17)**

where $x_n^2(\alpha)$ is the critical value of the chi-square statistic with sample size n and level of significance α.

4) Compare $\bar{\sigma}^2$ with σ^2, the variance of the logarithim of actual expenditures. If $\bar{\sigma}^2 < \sigma^2$, then the observed data are consistent with GARP. Otherwise, if $\bar{\sigma}^2 \geq \sigma^2$, the violation of GARP is statistically significant at level α.

Applying these procedures to each group of price and quantity data, the Tsur test statistics are calculated as follows:

Table 7: Tsur Test Statistics of GARP

Group	$\hat{\rho}$	n	$\bar{\sigma}^2\|_{\alpha=0.01}$	variance σ^2
1	0.0000173106	60	0.0000118	0.02357333
2	0.0000006541	65	0.0000005	0.02453974
3	0.0000019880	37	0.0000013	0.01187173
4	0.0000004108	37	0.0000003	0.00541966

The test results indicate that none of the data sets for the four groups of dairy products violate the GARP statistically. It can be inferred that there is a stable set of preferences for the products in question, consistent with utility maximization, so that variation in observed quantities consumed can be explained by changes in prices and expenditure. Thus, the results support the specified groupings of the dairy products in question. We therefore proceed to estimate price and income elasticities for the four groups of dairy products, treating each group as a weakly separable system and assuming that consumers follow a two-stage budgeting process. The imposition of the theoretical restrictions of homogeneity and symmetry is supported by the revealed preference test results; these restrictions are imposed in the subsequent parametric analysis.

VI. Empirical Results of the Parametric Analysis of Dairy Demand

Estimation Technique and Software Package

The linearized version of the almost ideal demand system, for each of the identified subsystems, as discussed above, is estimated using the iterative seemingly unrelated system regression procedure of SHAZAM (7.0). Since the model is based on expenditure shares, to avoid singularity of the variance-covariance matrix one share equation of each system is deleted in the estimation process. The iterative seemingly unrelated regression procedure ensures that the estimated results are not affected by the choice of the share equation to be dropped.

System One: Milk and Other Beverages

The final specification chosen for this linearized AIDS model includes time trend t, one period lagged own consumption in logarithm form and quarterly dummy variables. Aggregate quarterly data for the period 1979Q1-1993Q4 are used for estimation. The estimated coefficients and their standard errors are presented in Table 8. Most of the coefficients are highly significant. The estimates in Table 9 indicate that all the dependent variables except for orange juice are well explained. Durbin-Watson statistics in Table 9 show no evidence of serial correlation in the disturbances. The inclusion of dummy variables reveals that seasonality has a significant effect on the demand for all the beverages considered except for orange juice and concentrated milk. More specifically, while people consume relatively less low-fat milk and coffee and tea from April to September, their demand for soft drink increases in this period. Demand for whole milk and low-fat milk increases from July to December and demand for low-fat milk tends to increase in the last quarter of the calendar year.

Table 8: Estimated Coefficients and Standard Errors for the Milk and Other Beverages Group [1]
(1979Q1-1994Q4)

Variable	Parameter	(1) Whole Milk	(2) Low-Fat Milk	(3) Soft Drink	(4) Coffee & Tea	(5) Orange Juice	(6) Concentrated Milk
$\log p_1$	γ_{i1}	0.03267*	-0.00035	-0.02711**	-0.02913**	-0.00369**	0.02761**
		(0.01901)	(0.01601)	(0.00519)	(0.00339)	(0.00160)	(0.00999)
$\log p_2$	γ_{i2}	-0.00035	0.15845**	-0.06100**	-0.06292**	0.00469	-0.03887*
		(0.0161)	(0.02309)	(0.01028)	(0.00624)	(0.00331)	(0.02010)
$\log p_3$	γ_{i3}	-0.02711**	-0.06100**	0.09465**	-0.02868	-0.01923*	0.04136
		(0.00519)	(0.01028)	(0.03774)	(0.02677)	(0.01004)	(0.03118)
$\log p_4$	γ_{i4}	-0.02913**	-0.06292**	-0.02868	0.16375**	0.00040	-0.04342**
		(0.00339)	(0.00624)	(0.02677)	(0.03009)	(0.00891)	(0.01950)
$\log p_5$	γ_{i5}	-0.00369**	0.00469	-0.01923*	0.00040	0.01336**	0.00449
		(0.00160)	(0.00331)	(0.01004)	(0.00861)	(0.00563)	(0.00950)
$\log p_6$	γ_{i6}	0.02761**	-0.03887*	0.04136	-0.04342**	0.00449	0.00883
		(0.00999)	(0.02010)	(0.03118)	(0.01950)	(0.00950)	(0.04126)
$\log(X/P^*)$	β_i	-0.10100**	-0.22450**	0.26399**	0.06914	-0.04005	0.03241
		(0.00746)	(0.01612)	(0.06772)	(0.07120)	(0.02566)	(0.04962)
$\log q_{i,t-1}$	θ_i	0.07681**	0.13647**	0.01269	-0.00682	0.00189	3.76993**
		(0.00723)	(0.02865)	(0.02041)	(0.01753)	(0.00471)	(0.64794)
DM_2	λ_{i2}	-0.00082	-0.00550**	0.05715**	-0.04093**	-0.00234	-0.00756
		(0.00084)	(0.00185)	(0.00876)	(0.00822)	(0.00292)	(0.00687)
DM_3	λ_{i3}	0.00244**	-0.00566**	0.06941**	-0.05776**	-0.00468	-0.00375
		(0.00097)	(0.00240)	(0.00850)	(0.00912)	(0.00315)	(0.00659)
DM_4	λ_{i4}	0.00562**	0.00911**	0.01749**	-0.01878**	-0.00312	-0.01032
		(0.00079)	(0.00233)	(0.00806)	(0.00806)	(0.00269)	(0.00696)
t	δ_i	0.38119**	0.75720**	0.86428**	-0.00583	0.20720**	0.52452**
		(0.03517)	(0.08266)	(0.27061)	(0.28563)	(0.10308)	(0.20605)
constant	α_i	-0.00044**	0.00046**	0.00146**	0.00000	-0.00017	-0.00131**
		(0.00014)	(0.00014)	(0.00033)	(0.00032)	(0.00011)	(0.00038)

[1] Standard errors are shown in parentheses. The designation * and ** indicate two-tailed test significance at the 10% and 5% levels, respectively.

Table 9: Goodness of Fit and Durbin-Watson Statistics for Individual Equations, Milk and Other Beverages

	R^2	D-W
1. Whole Milk	0.9961	1.964
2. Low-Fat Milk	0.9895	2.1555
3. Soft Drink	0.9271	1.8695
4. Coffee and Tea	0.8333	1.9423
5. Orange Juice	0.565	1.8861

Time trend, t, and the habit persistence variable, $\log q_{i,t-1}$, are significant only in some equations. To assess their significance in this demand system, likelihood ratio (LR) tests are conducted which compare the values of log likelihood functions from the restricted model (Lr) with the unrestricted model (Lu) using the formula LR=-2(Lr-Lu). The LR test statistic is a χ_m^2 distribution where m is the number of restrictions. The LR test results are listed in Table 10. Both hypotheses that $H_0\!:\delta_i=0$ and $H_0\!:\theta_i=0$ are rejected significantly at the 5% level. Among these six beverage products, the consumption of whole milk, low-fat milk and concentrated milk shows significant evidence of habit formation, and the demand for both low-fat milk and soft drink shows an increase over time. In contrast, the demand for whole milk, orange juice and concentrated milk shows a decreasing trend over time.

Table 10: Likelihood Ratio Tests for Inclusion of Time Trend and Habit Formation, Milk and Other Beverages

Model	Log Likelihood Value	LR Test Statistic Value	Number of Restrictions	χ_5^2 at 5%
Dynamic LAIDS with time trend and habit variable	1146.28			
Dynamic LAIDS without habit variables $\log q_{i,t-1}$	1099.44	93.68	5	11.07
Dynamic LAIDS without time trend t	1122.26	48.04	5	11.07

Uncompensated own and cross-price elasticities and income elasticities are calculated at the sample means by (13) for each commodity. These estimates are listed in Table 11. All the own-price elasticities

Table 11: Milk and Other Beverages, Marshallian Price and Expenditure Elasticities at the Sample Means [1] (1979Q1-1993Q4)

	Price Variables						
Quantity Variables	Whole Milk	Low-Fat Milk	Soft Drink	Coffee & Tea	Orange Juice	Concentrated Milk	Expenditure
Whole Milk	-0.5931**	0.2212	0.0639	-0.0371	-0.0017	0.2922**	0.0545
	(0.1796)	(0.1497)	(0.0583)	(0.0349)	(0.0144)	(0.0927)	(0.0698)
Low-Fat Milk	0.0995	-0.1081	0.0608	-0.0294	0.0526**	-0.1299	0.0545
	(0.0680)	(0.1014)	(0.0534)	(0.0300)	(0.0134)	(0.0840)	(0.0679)
Soft Drink	-0.1646**	-0.3681**	-0.9823**	-0.2812**	-0.0846**	0.0950	1.7857**
	(0.0264)	(0.0571)	(0.1462)	(0.0906)	(0.0293)	(0.0916)	(0.2015)
Coffee & Tea	-0.1465**	-0.3184**	-0.2083	-0.4121**	-0.0081	-0.1841**	1.2774**
	(0.0330)	(0.0726)	(0.1521)	(0.1418)	(0.0339)	(0.0778)	(0.2857)
Orange Juice	0.0169	0.4080**	-0.1661	0.2983	-0.5760**	0.1701	-0.1512
	(0.0884)	(0.2024)	(0.4184)	(0.3144)	(0.1545)	(0.2729)	(0.7375)
Concentrated Milk	0.6750**	-1.3021*	0.8520	-1.4398**	0.0939	-0.7854	1.9063
	(0.3203)	(0.6724)	(1.1064)	(0.6498)	(0.2613)	(1.1427)	(1.3875)

[1] Standard errors are shown in parentheses. The designation * and ** indicate two-tailed test significance at the 10% and 5% levels, respectively.

have the expected signs; each is relatively price-inelastic and all but two are significant at the 5% level, the exceptions being low-fat milk and concentrated milk. Among 30 cross price elasticities, 16 are significant at the 5% level and 1 is significant at the 10% level. The signs on the cross-price elasticity estimates indicate that whole milk is a substitute for concentrated milk; a similar relationship is suggested for whole milk with low-fat milk and soft drink, but the latter relationships are not statistically significant. The results suggest that low-fat milk complements consumption of coffee and tea and concentrated milk and has a substitute relationship with all the other beverages; however only the substitute relationship with orange juice is significant. There is an apparent tendency for consumers to be less responsive to changes in low-fat milk prices than to changes in whole-milk prices. There is an apparent tendency for consumers to respond less in increasing consumption of whole milk when prices of low-fat milk increase than is the case with low-fat milk consumption when whole milk prices adjust, although these cross-price relationships are not hightly significant. The nature of these relationships is consistent with the results of the habit persistence variable for whole milk and low-fat milk. These suggest that habit formation is important for both milks, but is relatively more important for low-fat milk. Concentrated milk shows a strong complementary relationship with low-fat milk and coffee and tea, and a substitute relationship with whole milk. The expenditure elasticities for whole milk, low-fat milk, concentrated milk and orange juice are not statistically significant, which may suggest that income is not a factor significantly affecting the demand for these products. However, soft drinks and coffee and tea are expenditure-elastic commodities.

It is difficult to compare these estimates with previous studies as the demand estimates for milk by Moschini and Moro (for both 1962 to 1988 and 1986 to 1988) and by Hassan and Johnson (which relate to the period from 1950 to 1972) are for the aggregate grouping of fluid milk. Those estimates fall between the range reported here for whole milk and low-fat milk and thus do not appear to be inconsistent with the estimates reported here. Price elasticity estimates by Reynolds (1991) based on cross-sectional data from Statistics Canada's 1986 *Family Food Expenditure Survey* are higher than from these other studies, which all use time-series data. The tendency for lower-fat milk to exhibit relatively less own-price elasticity than whole milk also applies to the results reported by Reynolds.

System Two: Fats and Oils

The fat and oil products included in the group are butter, margarine, cooking/salad oil and shortening. Estimated coefficients for this system and goodness of fit tests for individual equations in the system are in Tables 12 and 13. Consumption and price data for these commodities are available from 1984Q4 to 1993Q4. The consumption series are per capita disappearance of butter and manufacturers' retail sales of packaged margarine, shortening and cooking/salad oil expressed in per capita terms. We also assessed consumption in terms of total packaged sales which is composed of both retail and commercial sales for each of the three specified products but found inconsistent results using these data series. An explanation of this inconsistency is that while a considerable portion of sales of fats and oils are for use as ingredients in

Table 12: Estimated Coefficients for the Fats and Oils Group [1] (1978Q1-1994Q1)

Variable	Parameter	(1) Butter	(2) Margarine	(3) Cooking/Salad Oil	(4) Shortening
$\Delta logp_1$	γ_{i1}	-0.03309 (0.20835)	-0.09123 (0.14696)	0.04573 (0.10410)	0.07859 (0.09119)
$\Delta logp_2$	γ_{i2}	-0.09123 (0.14696)	0.20421 (0.16787)	-0.00519 (0.10943)	-0.10779 (0.08326)
$\Delta logp_3$	γ_{i3}	0.04573 (0.10410)	-0.00519 (0.10943)	-0.03471 (0.12366)	-0.00583 (0.07543)
$\Delta logp_4$	γ_{i4}	0.07849 (0.09119)	-0.10779 (0.08326)	-0.00583 (0.07543)	0.03503 (0.08393)
$\Delta log(X/P^*)$	β_i	0.05098** (0.02126)	-0.04629** (0.01679)	0.00272 (0.01109)	-0.00740 (0.00940)
$\Delta lagX$	θ_i	-0.01614** (0.00524)	0.01226** (0.00414)	0.00115 (0.00269)	0.00272 (0.00229)
ΔDM_2	λ_{i2}	0.01733* (0.00907)	-0.00908 (0.00713)	-0.00844* (0.00467)	0.00019 (0.00397)
ΔDM_3	λ_{i3}	0.01005 (0.01095)	-0.01623* (0.00861)	-0.01039* (0.00566)	0.01656** (0.00480)
ΔDM_4	λ_{i4}	0.01967* (0.01009)	-0.02020** (0.00791)	-0.01760** (0.00521)	0.01812** (0.00444)

[1] Standard errors are shown in parentheses. The designation * and ** indicate two-tailed test significance at the 10% and 5% levels, respectively.

Table 13: Goodness of Fit and Durbin-Watson Test Results for Individual Equations, Fats and Oils Group

Dependent Variables	Butter	Margarine	Cooking/Salad Oil
R^2	0.4848	0.5153	0.3150
D.W.	2.5723	2.5094	2.5474

food processing and service industries, a large portion is also used for frying during manufacture and in restaurants. Eventually much of this is not consumed by humans but is processed for animal feed and other non-food purposes. Thus the alternative data set that includes this component may not reflect consumers' behaviour and consumption for fats and oils.

The initial estimation of this demand system excluding habit persistence variables but including quarterly seasonal dummy variables gave Durbin-Watson tests indicating the existence of autocorrelation. This problem persisted when the habit persistence variable was added to the LAIDS model. Therefore the first difference version of the LAIDS model was applied as in equation (12), initially including both a time trend and habit formation. However, the Likelihood Ratio test result, in Table 14, shows that H_0: $\delta_i=0$, i=1,..., n cannot be rejected at the 5% level indicating that time is not a factor in demand for fats and oils. Nonetheless, H_0: $\theta_i=0$, i=1,..., n is significantly rejected at the 5% level, suggesting that the demand for fats and oils is affected by the habit formation variable. We found that the inclusion of a dynamic term, in the form of the lagged expenditure variable, appears to reflect better the nature of habit persistence for these commodities than the lagged consumption variable. Thus, based on the LR test results, the best specification for the first difference LAIDS model excludes the constant term and includes seasonal dummy variables and the habit persistence variable, modelled as lagged expenditure on the fats and oils group (denoted by ΔlagX in the tables summarizing these results).

Table 14: Likelihood Ratio Tests for Time Trend and Habit Formation, Fats and Oils Group

Models	Log Likelihood Value	LR Test Statistic Value	Number of Restrictions	χ_3^2 at 5%
With time and habit variables	508.958			
Without habit variables ΔlagX	503.768	10.38	3	7.815
Without time trend (no constant)	508.897	1.103	3	7.815

The estimated coefficients and their standard errors for each equation in the system, with restrictions imposed, are presented in Table 12. Standard errors are higher than for the milk and other beverages group, reflecting the problem of multicollinearity that affects the data set for fats and oils, arising from correlation between the price series for cooking/salad oil with both margarine and shortening. Deletion from the system of shortening, a minor item in consumption, did not improve the estimates. Margarine and cooking/salad oil are considered to be sufficiently important consumption items that deletion of either of these would constitute misspecification of the demand system for fats and oils. Habit formation evidently affects the demand for butter and margarine. Seasonal variation in consumption is significant for all four fat and oil products. The goodness of fit, as listed in Table 13, is not high; it is not unusual to find this for share models fitted in first difference form (Moschini and Moro, 1993).

Marshallian price elasticities and expenditure elasticities for each commodity are calculated at their sample means and are listed in Table 15. The estimated expenditure elasticities are highly significant, but the standard errors of price elasticities are relatively high, a consequence of the multicollinearity noted above. The own price elasticity estimates suggest that butter and salad oil are price-elastic and margarine and shortening are price-inelastic. The positive cross-price elasticities indicate substitute relationships between butter and cooking/salad oil as well as butter and shortening. In contrast, complementary relationships apply between the other pairs of fats and oils. The tendency for complementarity to be exhibited from aggregate consumption patterns of butter and margarine appears counter intuitive to the common perception of these as substitute products for many individual consumers or in many uses. However, numbers of other studies have found indications of complementarity between butter and margarine in various countries (Pitts and Herlihy 1982). Estimates of negative cross-price elasticities for butter and margarine consumption in Canada based on Canadian data are consistently reported by Goddard and Amuah (1989) and are also reported by Chang and Kinnucan (1991, 1992). Chang and Kinnucan only report positive cross-elasticities estimates for Canadian butter and margarine from single-equation models.

Following Pitt and Herlihy, a possible hypothesis that may be applied to explain the apparent complementarity between butter and margarine is that households may tend to spend a fixed amount of

Table 15: Fats and Oils, Marshallian Price Elasticities and Expenditure Elasticities at the Sample Means [1]
(1978Q1-1994Q1)

Quantity Variables	Price Variables				
	Butter	Margarine	Cooking/Salad Oil	Shortening	Expenditure
Butter	-1.1115** (0.3802)	-0.1948 (0.2693)	0.0739 (0.1907)	0.1392 (0.1668)	1.0932** (0.0389)
Margarine	-0.2192 (0.4882)	-0.2745 (0.5586)	-0.0013 (0.3646)	-0.3510 (0.2769)	0.8460** (0.0559)
Cooking/Salad Oil	0.4257 (0.9989)	-0.0578 (1.0509)	-1.3368 (1.1920)	-0.0574 (0.7254)	1.0262** (0.1067)
Shortening	1.7027 (1.8789)	-2.1750 (1.7158)	-0.1043 (1.5570)	-0.2709 (1.7284)	0.8475** (0.1936)

[1] Standard errors are shown in parentheses. The designation * and ** indicate two-tailed test significance at the 10% and 5% levels, respectively.

expenditure on fats and oils. If the price of margarine increases, since its own price elasticity of demand is -0.25, the proportional decline in margarine consumption is evidently less than its proportional increase in price. Thus, although the quantity consumed will have fallen, the expenditure on margarine will increase. If the household budget for fats and oils tends to be fixed, a decrease in expenditure on one or more of the other commodities in the system will be observed. In the case of this study, the cross-price elasticities between margarine and the other fats and oils in the group are all negative, indicating that expenditure on each item falls. The implications of price increases for butter are somewhat different, in

view of the price-elastic estimate of demand for this commodity. With an increase in the price of butter, the consumption decrease for this item is proportionately greater than the price increase. Thus expenditure on butter declines, enabling an increase in expenditure on other fats and oils. If there are only two commodities in the demand system, for example, butter and margarine, margarine necessarily must substitute for butter. With more than two commodities, the released expenditure is available for distribution among all or some of the other items in the system. From the results of this study, such increases in expenditure occur for cooking/salad oil and shortening, rather than margarine. Alternatively, the existence of negative cross-price elasticity estimates for butter and margarine may simply reflect the feature that many households may buy both these commodities.

The estimates in Table 15 also indicate that the demand for cooking/salad oil and shortening increases by a much larger percentage when the price of butter increases than is the case for the change in consumption of butter when the prices of cooking/salad oil and shortening change. That is, amongst these substitute products, salad oil and shortening apparently substitute more for butter than vice versa. Butter and cooking/salad oil are expenditure-elastic products, but margarine and shortening are relatively expenditure inelastic. Compared to the results from other studies, the own price elasticity estimates tend to be somewhat higher for butter and lower for margarine than were reported by Hassan and Johnson (based on data previous to 1973) and Goddard and Amuah (on data from 1973 to 1986). The expenditure elasticity estimates are generally comparable to those reported by Goddard and Amuah. As is generally the case for expenditure elasticities, these are higher than income elasticity estimates such as by Hassan and Johnson (1976).

System Three: Dairy Dessert and Related Products

The LAIDS model which best explains consumer's behaviour for dairy dessert and related products, a group that includes ice cream, yogurt, cottage cheese and cream, includes dynamics and quarterly dummy variables. Time trend and habit formation appear in the forms of logt and $\log q_{i,t-1}$, respectively. Most of the estimated coefficients in Table 16 are significant. The tests of goodness of fit and the D-W tests reported in Table 17 are satisfactory. The LR test results in Table 18 favour the inclusion of both time trend and habit formation variables. Yogurt, in particular, has followed an increasing trend in consumption and appears to exhibit habit persistence. Demand for these products varies seasonally; this is particularly evident for ice cream and yogurt. Of the 16 price elasticity estimates listed in Table 19, 4 are significant at the 10% level, and 6 are significant at the 5% level. All the products are price-inelastic. Yogurt is relatively more price-

Table 16: Estimated Coefficients and Standard Errors for Dairy Dessert and Related Products [1]
(1984Q4-1993Q4)

Variable	Parameter	(1) Ice Cream	(2) Yogurt	(3) Cottage Cheese	(4) Cream
$\log p_1$	γ_i	0.09811	-0.10428*	-0.04989	0.05606
		(0.07382)	(0.06254)	(0.03403)	(0.07149)
$\log p_2$	γ_{i2}	-0.10428*	0.07209	0.10112**	-0.06893
		(0.06254)	(0.09792)	(0.04985)	(0.07759)
$\log p_3$	γ_{i3}	-0.04989	0.10112**	0.06369	-0.11492**
		(0.03403)	(0.04985)	(0.04511)	(0.03604)
$\log p_4$	γ_{i4}	0.05606	-0.06893	-0.11492**	0.12779
		(0.07149)	(0.07759)	(0.03604)	(0.10342)
log(X/P*)	β_i	0.09576	0.18507**	-0.03390	-0.24693**
		(0.06067)	(0.06207)	(0.02655)	(0.07860)
$\log q_{i,t-1}$	θ_i	0.01591	0.02861**	-0.00254	-0.00863
		(0.01737)	(0.00989)	(0.00353)	(0.01645)
DM_2	λ_{i2}	0.05165**	-0.05829**	0.00001	0.00663
		(0.00853)	(0.00986)	(0.00402)	(0.01169)
DM_3	λ_{i3}	0.04251**	-0.06851**	-0.00060	0.02660**
		(0.00872)	(0.00856)	(0.00354)	(0.01149)
DM_4	λ_{i4}	-0.02231**	-0.05235**	-0.00367**	0.07833**
		(0.00873)	(0.00455)	(0.00184)	(0.00954)
log(t)	δ_i	-0.02211**	0.01950**	-0.01064**	0.01326**
		(0.00355)	(0.00400)	(0.00199)	(0.00524)
Constant	α_i	-0.00647	-0.28861*	0.19890**	1.09620**
		(0.14485)	(0.14870)	(0.06345)	(0.18656)

[1] Standard errors are shown in parentheses. The designation * and ** indicate two-tailed test significance at the 10% and 5% levels, respectively.

Table 17: Goodness of Fit and Durbin-Watson Test Results for Individual Equations, Dairy Dessert and Related Products

Dependent Variables	Ice Cream	Yogurt	Cottage
R^2	0.9732	0.9138	0.9488
D-W	1.6896	1.5052	1.927

Table 18: Likelihood Ratio Tests for Time Trend and Habit Formation, Dairy Dessert and Related Products

Model	Log Likelihood Value	LR Test Statistics	Number of Restrictions	χ_3^2 at 5%
With time and habit variables	420.344			
Without habit variable $\log q_{i,t-1}$	416.313	8.062	3	7.815
Without time trend log t	395.965	48.758	3	7.815

Table 19: Dairy Dessert and Related Products, Marshallian Price and Expenditure Elasticities at the Sample Means[1] (1994Q4-1993Q4)

Quantity	Price Variables				
Variables	Ice Cream	Yogurt	Cottage	Cream	Expenditure
Ice cream	-0.6241*	-0.5895*	-0.2788*	0.0319	1.4604**
	(0.3615)	(0.3233)	(0.1696)	(0.3165)	(0.2917)
Yogurt	-0.7462**	-0.8083	0.4468*	-0.8596**	1.9673**
	(0.3303)	(0.5487)	(0.2631)	(0.3152)	(0.3244)
Cottage Cheese	-0.5071	1.2738**	-0.2121	-1.1533**	0.5987*
	(0.4065)	(0.6005)	(0.5433)	(0.3620)	(0.3142)
Cream	0.2081	-0.0420	-0.1822**	-0.5055**	0.5216**
	(0.1489)	(0.1670)	(0.0734)	(0.1650)	(0.1523)

[1] Standard errors are shown in parentheses. The designation * and ** indicate two-tailed test significance at the 10% and 5% levels, respectively.

responsive than other items in this group and cottage cheese is the least price-responsive. Strong substitute relationships are found between yogurt and cottage cheese and are suggested for ice cream and cream although these coefficients are not significant. Complementary relationships are evident for ice cream and yogurt and also for ice cream and cottage cheese as well as for yogurt and cream. Complementarity also applies for cottage cheese and ice cream. All the expenditure elasticities are significant. The demand for ice cream and yogurt is expenditure elastic; the estimates for cottage cheese and cream are somewhat lower. No other comparison estimates are available for these particular individual dairy products.

System Four: Cheese and Apparent Substitutes

Commodities in this group include cheddar cheese, the category of other or specialty cheese (which relates primarily to mozzarella cheese, the largest item of other/specialty cheese consumed in Canada) and other protein products, specifically eggs, beef, pork and chicken. We initially and unsuccessfully tried to treat processed cheese, which is included in cheddar cheese, as a separate commodity.

The data for this group are best described by the first difference version of the linear AIDS model which incorporates a time trend, habit formation and seasonality. Specifically, the importance of the time trend is implied by the statistical significance of the constant term and habit persistence is modelled best by lagged expenditure on cheese and apparent substitutes (denoted by ΔlagX). The estimated coefficients for the period 1984Q4 to 1993Q4 are displayed in Table 20. Goodness of fit and Durbin-Watson test results are indicated in Table 21. Multicollinearity is evident in the price series for this group of commodities. Seasonality in demand applies for the commodities in this system. The results of the LR test for the existence of dynamics, given in Table 22, indicate that in this system, time trend is significant at the 5% level and the variable representing habit formation is significant at about 10%. The trends have been positive in consumption of other cheese and chicken and negative for beef. The habit formation variable is significant for other cheese, eggs and chicken.

As shown in Table 23, all the expenditure elasticities are highly significant. Cheddar cheese, other

Table 20: Estimated Coefficients for Cheese and Apparent Substitutes [1] (1984Q4-1993Q4)

Variable	Parameter	(1) Cheddar Cheese	(2) Other Cheese	(3) Eggs	(4) Beef	(5) Pork	(6) Chicken
$\Delta logp_1$	γ_{i1}	0.02440 (0.10812)	0.04153 (0.10765)	0.00681 (0.02214)	-0.10660* (0.06397)	0.00730 (0.04058)	0.02657 (0.03118)
$\Delta logp_2$	γ_{i2}	0.04153 (0.10765)	-0.02192 (0.12295)	-0.00441 (0.02580)	0.11107 (0.07282)	-0.07247* (0.03780)	-0.05382* (0.02994)
$\Delta logp_3$	γ_{i3}	0.00681 (0.02214)	-0.00441 (0.02580)	0.02577** (0.01023)	-0.01642 (0.01124)	0.00029 (0.00683)	-0.01205* (0.00660)
$\Delta logp_4$	γ_{i4}	-0.10660* (0.06397)	0.11107 (0.07282)	-0.01642 (0.01124)	0.04123 (0.14231)	-0.01151 (0.07591)	-0.01777 (0.04294)
$\Delta logp_5$	γ_{i5}	0.00730 (0.0406)	-0.07247* (0.0378)	0.00029 (0.0068)	-0.01151 (0.0759)	0.06818 (0.0646)	0.00820 (0.0266)
$\Delta logp_6$	γ_{i6}	0.02657 (0.03118)	-0.05382* (0.02994)	-0.01205* (0.00660)	-0.01777 (0.04294)	0.00820 (0.02663)	0.04886* (0.02806)
$\Delta log(X/P^*)$	β_i	0.00819 (0.00830)	0.01125 (0.00741)	-0.00324** (0.00120)	-0.00861 (0.01476)	0.00348 (0.01177)	-0.01107** (0.00506)
$\Delta lag(X)$	θ_i	-0.00023 (0.00038)	-0.00060** (0.00034)	0.00012** (0.00006)	0.00044 (0.00068)	-0.00021 (0.00054)	0.00049** (0.00023)
ΔDM_2	λ_{i2}	0.00401* (0.00239)	-0.00152 (0.00216)	-0.00036 (0.00036)	0.02507** (0.00424)	-0.03020** (0.00332)	0.00299** (0.00151)
ΔDM_3	λ_{i3}	-0.00017 (0.00322)	0.00980** (0.00288)	-0.00037 (0.00049)	0.01327** (0.00589)	-0.02222** (0.00485)	-0.00031 (0.00200)
ΔDM_4	λ_{i4}	0.00010 (0.00286)	0.01557** (0.00254)	0.00218** (0.00044)	-0.00691 (0.00504)	-0.00043 (0.00412)	-0.01051** (0.00174)
Constant	α_i	0.00032 (0.00117)	0.00178* (0.00105)	-0.00025 (0.00017)	-0.00282 (0.00208)	-0.00010 (0.00166)	0.00106 (0.00071)

[1] Standard errors are shown in parentheses. The designation * and ** indicate two-tailed test significance at the 10% and 5% levels, respectively.

Table 21: Goodness of Fit and Durbin-Watson Test Results for Individual Equations, Cheese and Apparent Substitutes

Dependent Variables	Cheddar Cheese	Specialty Cheese	Eggs	Beef	Pork
R^2	0.2552	0.6097	0.8689	0.6559	0.7954
DW	2.7384	2.8218	2.7044	3.1112	2.623

Table 22: Likelihood Ratio Tests for Time Trend and Habit Formation, Cheese and Apparent Substitutes

Model	Log Likelihood Value	LR Test Statistics	Number of Restrictions	χ_5^2 at 10%	χ_5^2 at 5%
With time and habit variables	749.167				
Without habit variables ΔlagX	744.637	9.06	5	9.24	11.07
Without time trend (constant term)	743.590	11.154	5	9.24	11.07

Table 23: Cheese and Apparent Substitutes, Marshallian Price and Expenditure Elasticities at the Sample Means[1] (1984Q4-1993Q4)

	Price Variables						
Quantity Variables	Cheddar Cheese	Other Cheese	Eggs	Beef	Pork	Chicken	Expenditures
Cheddar Cheese	-0.6597 (1.5435)	0.5807 (1.5389)	0.0927 (0.3162)	-1.5635* (0.9112)	0.0726 (0.5834)	0.3602 (0.4448)	1.1170** (0.1186)
Other Cheese	0.3849 (1.0164)	-1.2183 (1.1627)	-0.0457 (0.2437)	1.0120 (0.6855)	-0.7133** (0.3599)	-0.5258* (0.2824)	1.1062** (0.0700)
Eggs	0.1825 (0.5739)	-0.1054 (0.6696)	-0.3283 (0.2654)	-0.3964 (0.2906)	0.0303 (0.1785)	-0.2986* (0.1708)	0.9159** (0.0310)
Beef	-0.3022* (0.1825)	0.3193 (0.2081)	-0.0459 (0.0320)	-0.8738** (0.4043)	-0.0262 (0.2180)	-0.0466 (0.1226)	0.9754** (0.0421)
Pork	0.0261 (0.1499)	-0.2691* (0.1401)	0.0006 (0.0252)	-0.0470 (0.2794)	-0.7516** (0.2400)	0.0282 (0.0985)	1.0129** (0.0435)
Chicken	0.1665 (0.1899)	-0.3206* (0.1826)	-0.0708* (0.0402)	-0.0846 (0.2607)	0.0682 (0.1632)	-0.6914** (0.1708)	0.9326** (0.0308)

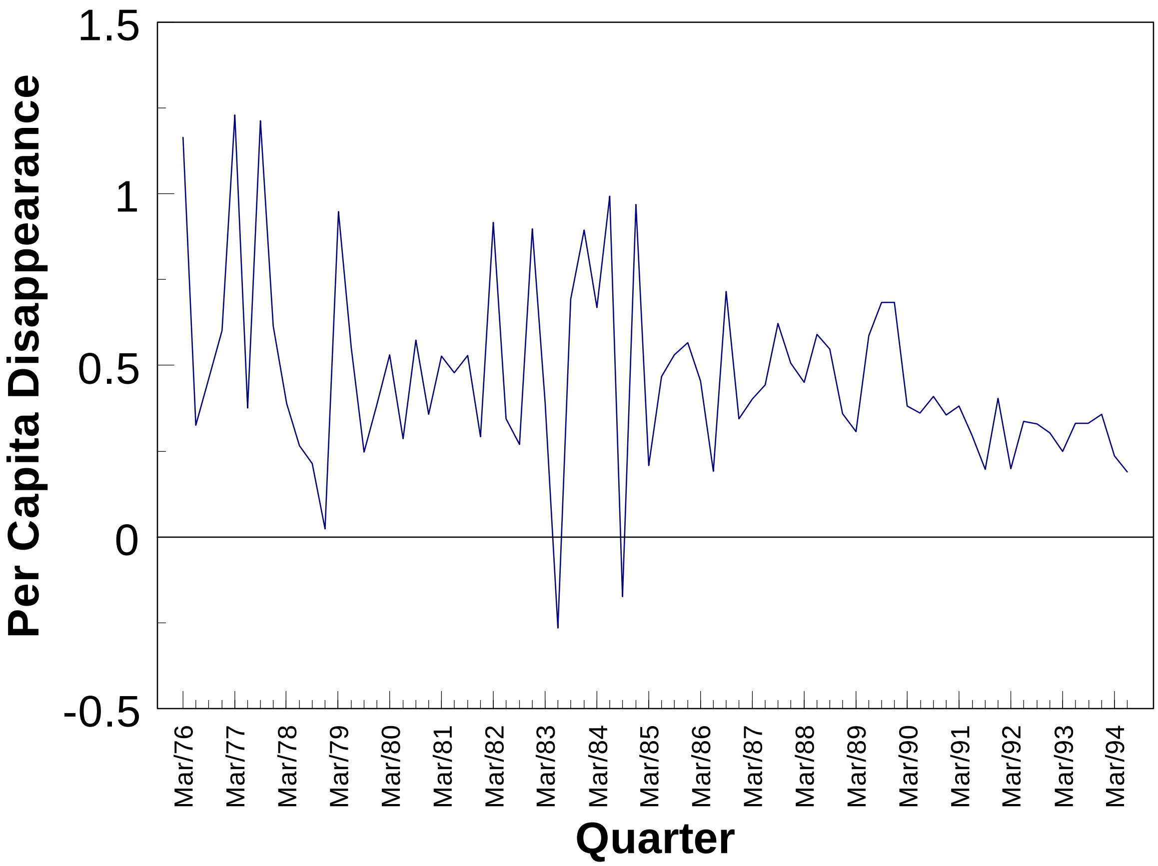
[1] Standard errors are shown in parentheses. The designation * and ** indicate two-tailed test significance at the 10% and 5% levels, respectively.

the most price-inelastic product of the group. Comparison of price elasticity estimates for this group with those from the studies by Hassan and Johnson (1976) and Moschini and Moro (1993) shows generally comparable results, although the price elasticity estimate for eggs from this study is somewhat higher, but still relatively price-inelastic. Moschini and Moro's price-elasticity estimate for cheese is for cheddar cheese alone, and is slightly lower (at -0.55) than the estimate of -0.66 of this study. The earlier estimate for cheese by Hassan and Johnson however, relates to the aggregate of all cheeses and is somewhat higher (at -0.86) than Moschini and Moro's estimate for cheddar cheese, a feature that accords with the indication from this study that the demand for other (specialty) cheese exhibits more price responsiveness than does the demand for cheddar cheese. The two cheese types appear to substitute for each other. Cheddar cheese appears to be complementary in consumption with beef but a consumption substitute for eggs, pork and chicken, while other cheese appears to relate to these four high protein products in the opposite manner to cheddar cheese; however, these cross-price elasticity estimates are not significant.

The Results for Skim Milk Powder

The estimation of price and income elasticity demand parameters for skim milk powder (SMP) poses particular problems. These problems are not unexpected in view of certain characteristics of the Canadian market and the data series for this product. These include the highly regulated market for this product, the traditional nature of skim milk powder production as a residual joint product with butter; and the fact that prices and stocks of skim milk powder at the wholesale level reflect administered target floor prices and market clearing activities that are put into effect by the Canadian Dairy Commission. Further, there are apparent inconsistencies in the data series available for skim milk powder, as shown by the extensive variability in per capita disappearance data, especially in earlier years and the indication of poor data quality shown in two instances of apparent negative disappearance (Figure 21).

Figure 21: Quarterly Canadian Per Capita Disappearance of Skim Milk Powder, Kilograms Per Person



Preliminary estimation included skim milk powder in the "Fluid Milks and Related Beverages" group. This increased the number of violations of revealed preference and did not give a negative estimate of own price elasticity for skim milk powder. Anomalous results were also found when skim milk powder was assessed as a potential member of two other dairy product groups, specifically, cheeses and dairy desserts. In each instance the inclusion of skim milk powder introduced problems in the estimated results for these systems.These problems were typically counter-theoretic skim milk powder price elasticity estimates and unstable results. It is concluded that skim milk powder is not appropriately included in any of the four dairy demand subsystems that are identified in this study. It may be that skim milk powder and other dairy proteins should appropriately be viewed as a fifth dairy demand subsystem but price series for related products such as whey and casein are not available. Thus, given current data series and for the reasons outlined above, system estimation was not possible for this commodity. It was, therefore, necessary to pursue the process of single equation estimation to analyse demand for skim milk powder.

From the theory of consumer behaviour, consumer's demand for a commodity is expected to depend on the prices of the available commodities and total expenditure. Based on the concept of weak separability and the related process of two-stage budgeting, it is assumed that the demand for skim milk powder is only affected by the prices of food products and total expenditure on foods. Thus:

$$Q_{SMP}=f(P_{SMP},P_1,\cdots,P_n,P_f,E_f) \qquad \textbf{(18)}$$

where Q_{smp} and P_{smp} are the per capita disappearance and price of skim milk powder, E_f is per capita expenditure on food including non-alcoholic beverages, P_1, ... P_n denote the prices of the dairy and substitute products concluded to be relevant in the preceding analyses of dairy products and related foods and P_f denotes the price of other food. The consumer price index for food and non-alcoholic beverages is used as a proxy for P_f . Data for the period from 1984Q1 to 1993Q4 are used in order to exclude the two anomalous data observations of negative per capita disappearance. A double-logarithmic functional form is chosen as the single-equation demand function specification.

The process of estimation started with the inclusion of prices for all 22 of the dairy and related products specified in the preceding analyses. These were then reduced, one at a time, dropping each time the least significant price variable until the prices of all remaining commodities were significant. This procedure gave two related product prices, the price of chicken, P_{ck}, and the price for other food, P_f, as relevant related products affecting the demand for skim milk powder. Since major uses of skim milk powder are as a milk protein in a variety of processed foods and likely substitutes for this milk protein are other food protein sources, such as whey powder and casein (for which time series data on prices and consumption are not available) it can be concluded that the price of chicken is the best available proxy variable, for which data are available, of prices of protein substitutes to skim milk powder.

Two variants of the basic single-equation model of demand for skim milk powder are tested. No significant seasonality is found in the demand for skim milk powder and thus seasonal dummy variables are not included in this model. Based on the observation of an apparent decline in the per capita consumption data for skim milk powder from 1990 (Figure 21) a dummy variable DD, defined as one for the period following 1990Q1 and zero elsewhere, is added to the intercept of the model. This variable is significant, suggesting that there is a structural change in the consumption data for skim milk powder from 1990 onwards. It is hypothesized that this apparent structural change is related to changes in the administrative support procedures of the Canadian Dairy Commission (CDC). Specifically, the Canadian Milk Supply Management Committee of CDC reduced national market sharing quota by 3% in January 1990 and by a further 3% in August 1991.

First order autocorrelation was apparent in initial testing of the model; this problem is reduced with the addition of a single-period lagged dependent variable, LQ_{smp}, to the explanatory variables, based on the hypothesis that technical or institutional rigidities hamper the adjustment of purchases of skim milk powder to desired levels. The resulting first specification of the demand model includes, in addition to skim milk powder price, single-period lagged per capita disappearance LQ_{smp}, P_{ck}, P_f, E_f and the dummy variable DD, as the hypothesized explanatory variables. This is estimated using the ordinary least squares procedure of SHAZAM. The results are in Table 24.

One basic property of well behaved demand functions is that these exhibit homogeneity of degree zero in prices and income. That is, when all prices and total expenditure change by the same proportion, there is no change in quantity demanded. The results of the first specification, in Table 24, are tested for homogeneity. This property requires that the sum of the own-price, cross-price and income elasticities for skim milk powder add to zero. The test result indicates that the sum of the four coefficients is not significantly

Table 24: Results of Two Specifications of the Single Equation Model of Demand for Skim Milk Powder

Specification 1:

$$Q_{smp} = \underset{(6.759)}{-14.266} \underset{(0.136)}{-0.2343}LQ_{smp} \underset{(2.223)}{-1.3435}P_{smp} \underset{(1.431)}{+3.5036}P_{ck} \underset{(3.215)}{-5.0087}P_f \underset{(1.123)}{+1.9556}E_f \underset{(0.20)}{-0.4808}DD. \quad \text{s.e.}$$

$R^2 = 0.5134$,

Specification 2:

$$Q_{smp} = \underset{(12.23)}{-10.188} \underset{(0.134)}{-0.1869}LQ_{smp} \underset{(2.156)}{-0.4627}(P_{smp}/P_f) \underset{(1.196)}{+2.390^{**}}(P_{ck}/P_f) \underset{(1.139)}{+1.8121}(E_f/P_f) \underset{(0.149)}{-0.6658^{**}}DD.$$

$R^2 = 0.5516$,

different from zero. In addition to providing some support for the model, confirmation that the property of homogeneity of degree zero holds also confirms that the demand for skim milk powder can be specified as a function of relative prices and real expenditure and that parameter estimates will not be biased by deflation. The deflator is chosen to be P_f, in order to conserve degrees of freedom. The consequent preferred second specification of the demand function for skim milk powder is:

$$\log(Q_{SMP}) = \alpha + \beta\log(Q_{SMP-1})_{t-1} + \gamma_1\log(P_{SMP}/P_f) + \gamma_2\log(P_{CK}/P_f) + \gamma_3\log(E_f/P_f) + \delta DD + u_t. \qquad \textbf{(19)}$$

where γ_1, γ_2 and γ_3 are, respectively, the estimates of own price elasticity of skim milk powder, the cross price elasticity of skim milk powder with respect to chicken price and the skim milk powder expenditure elasticity. Based on the property of homogeneity, the cross price elasticity of demand for skim milk powder with respect to P_f can be calculated as $\sum_1^3 \gamma_i$. The estimates of Equation 19 are in Table 24. Auxiliary tests indicate that the problem of multicollinearity, which is apparent for the first specification, is much reduced. The standard error of the coefficient on the own price variable is higher and the R^2 is lower than desired but the equation is relatively stable, yields sensible results and better explains variation in per capita disappearance of skim milk powder than any other approach that we assessed.

From these results the demand for skim milk powder is price inelastic--the estimated own price elasticity of demand is -0.46. If inclusion of the lagged dependent variable into this model is taken into account to calculate an estimate of the long-run elasticity of demand, the long-run equilibrium own-price elasticity estimate is somewhat lower, based on -0.463/(1+0.187)=-0.39. These estimates are reasonably consistent with the own-price elasticity parameter reported in 1976 by Hassan and Johnson for skim milk powder (-0.19), since it can be expected that current estimates of the absolute value of this parameter will exceed much earlier estimates as changes in food processing technology over the past two decades have widened the range of dairy food protein substitutes. Nonetheless, demand for skim milk powder is relatively price-inelastic. The expenditure elasticity for skim milk powder from this study is 1.1, implying that a one percent rise in total expenditure on food and non-alcoholic beverages will be associated with an increase in skim milk powder expenditure by 1.1 percent. Recognizing that expenditure elasticity estimates tend to exceed income elasticity measures, there appears to have been an increase in expenditure (income) elasticity of demand for skim milk powder, relative to the results reported in 1976 by Hassan and Johnson. This may have arisen from an increasing use of skim milk powder as an input in the processing of manufactured and specialty food items. It can be hypothesized that this tendency may also underly the relatively large expenditure-elasticity estimate for concentrated milk that was obtained from the results for the first commodity sub-group.

VII. Summary of Conclusions and Suggestions for Further Research

The purpose of this study is to derive a set of updated and disaggregated estimates of demand for major dairy products in a manner consistent with the economic theory of consumer behaviour. To this effect, four weakly separable groupings of major dairy products and related foods are specified. These are milk and other beverages, fats and oils, dairy dessert and related products and cheeses and apparent substitutes. Skim milk powder is assessed not to be a member of any of these weakly separable groups; it is hypothesized to be a member of a fifth dairy subgroup of dairy protein products but since data are only available for one of these, skim milk powder, it was necessary to follow a single-equation approach to estimation of demand parameters for this product.

The appropriateness of each product grouping was assessed by a two-stage test. Each subgroup was first tested, using non-parametric tests of the axioms of revealed preference, as a means of inferring whether or not choices within each subgrouping are consistent with constrained utility maximization. Second, parametric assessment of each subgroup gave further evidence regarding the appropriateness of the groupings in terms of whether the estimated demand parameters are relatively stable and plausible. Based on satisfactory performance in these tests, parametric analyses for each subgroup were conducted using the linearized version of the almost ideal demand system, incorporating also appropriate seasonality and habit formation variables for each subgroup.

The estimates of own-price, cross-price and expenditure elasticities of demand are presented in the preceding Tables 11, 15, 19, 23 and 24. These are discussed in the earlier sections of the report. Multicollinearity affects two groups, fats and oils and cheese and apparent substitutes. Under these circumstances, the estimated elasticities may still provide accurate forecasts if the pattern of interrelationship among the affected prices is the same in the forecast period as in the sample period (Judge *et al*, 1985). In general the price elasticity estimates seem plausible. Signs on the own-price elasticity estimates are as expected; the magnitudes appear to be reasonable. As expected, relatively few of the specified foods are price-elastic. Butter, cooking/salad oil and other cheese appear to be in this category. Relatively more of the items are relatively expenditure elastic. In general, however, the expenditure elasticities generated from the approaches of this study are, as expected, rather higher than the income elasticities generated from a full demand system, such as Hassan and Johnson (1976) or Moschini and Moro (1993). A summary of own-price and expenditure elasticities is given in Table 25.

Table 25: Summary of Own Price and Expenditure Elasticity Estimates [1]

Product	Own-Price Elasticity	Expenditure Elasticity
	Group I	
Whole Milk	-0.59**	0.06
	(0.18)	(0.07)
Low-Fat Milk	-0.11	0.06
	(0.10)	(0.07)
Soft Drink	-0.98**	1.79**
	(0.15)	(0.20)
Coffee and Tea	-0.41**	1.28**
	(0.14)	(0.29)
Orange Juice	-0.58**	-0.15
	(0.16)	(0.77)
Concentrated Milk	-0.78	1.91
	(1.14)	(1.39)
	Group II	
Butter	-1.11**	1.09**
	(0.38)	(0.04)
Margarine	-0.28	0.85**
	(0.56)	(0.06)
Cooking/Salad Oil	-1.34	1.03**
	(1.19)	(0.11)
Shortening	-0.27	0.85**
	(1.73)	(0.19)
	Group III	
Ice Cream	-0.62*	1.46**
	(0.36)	(0.29)
Yogurt	-0.81	1.97**
	(0.55)	(0.32)
Cottage Cheese	-0.21	0.60*
	(0.54)	(0.31)
Cream	-0.51**	0.52**
	(0.17)	(0.15)
	Group IV	
Cheddar Cheese	-0.66	1.12**
	(1.54)	(0.12)
Other Cheese	-1.22	1.11**
	(1.16)	(0.07)
Eggs	-0.33	0.92**
	(0.27)	(0.03)
Beef	-0.87**	0.98**
	(0.40)	(0.04)
Pork	-0.75**	1.01**
	(0.24)	(0.04)
Chicken	-0.69**	0.93**
	(0.17)	(0.03)
	Single Equation	
Skim Milk Powder	-0.46	1.81
	(2.16)	(1.14)

[1] Standard errors are shown in parentheses.

In the light of the analysis outlined here, there are some areas in which further research work seems warranted. Data availability restricted the disaggregation of fluid milk into two categories, fluid milk and low-fat milk. It is of interest to attempt to disaggregate further the latter category, since patterns of consumption for milk with 2% fat, 1% fat and skim milk (as well as the minor fluid commodities of chocolate milk and butter milk) may vary appreciably in consumption. It may be easier to develop an accurate data set for these commodities at the provincial level rather than the national level, due to the nature of regulation for fluid milk. Similarly, lack of data constrained the analysis of cheese consumption to two categories, cheddar (including processed cheese) and other (specialty) cheese. Disaggregation of the latter category is of interest for policy modelling. It would require disaggregation of the consumption series into mozzarella consumption and other specialty cheese consumption and would also require an appropriate specialty cheese price series. The only feasible source for such a price series would seem to be import data. Assessment of the availability of such a series is recommended.

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Appendix A

Table 1. Quarterly Per Capita Disappearance of Fluid Milks and Related Beverages (1979Q1-1993Q4)

Period	Whole Milk L	Low-Fat Milk L	Soft Drink L	Orange Juice Kg	Coffee & Tea Kg	Concentrated Milk Kg
1979Q1	10.3261	15.3220	14.1675	0.9896	1.1865	0.5710
1979Q2	10.2137	15.1382	17.9119	1.0716	1.2547	1.7525
1979Q3	10.2840	14.8785	20.2289	0.8731	1.2536	1.4396
1979Q4	10.5739	15.9345	16.9272	1.1708	1.0985	0.5907
1980Q1	10.1577	15.5738	13.7541	1.0039	1.2585	1.0000
1980Q2	9.9910	15.3940	17.1333	1.2369	1.2199	1.0216
1980Q3	10.1368	15.1956	19.6049	1.0336	0.9065	1.6988
1980Q4	10.2175	16.0312	15.1637	0.8941	1.2858	1.1408
1981Q1	9.7877	15.7193	14.2453	1.1911	1.4291	1.5211
1981Q2	9.5850	15.4807	18.2618	1.0066	1.2844	1.1529
1981Q3	9.7368	15.3076	19.1299	0.9471	1.0391	2.4421
1981Q4	9.8824	16.3972	16.7105	1.1456	1.3559	0.5401
1982Q1	9.3849	16.0643	13.0904	1.0912	1.1862	1.4267
1982Q2	9.2391	16.0162	18.1306	1.1418	1.1226	1.2930
1982Q3	9.2050	15.7279	19.5715	0.7825	1.0660	1.6448
1982Q4	9.2468	16.6079	15.7209	0.6099	1.2215	1.0271
1983Q1	8.7701	16.3120	13.5021	0.9319	1.2472	1.1925
1983Q2	8.5523	16.1655	17.7621	0.9183	1.0536	0.8410
1983Q3	8.7107	16.1636	20.8058	0.9894	1.1061	0.9797
1983Q4	8.8385	16.9307	17.0358	0.7201	1.1845	1.3623
1984Q1	8.4667	16.9312	14.8664	1.2545	1.2338	0.5290
1984Q2	8.1868	16.5255	18.2370	0.8150	1.2786	1.1974
1984Q3	8.0595	16.1484	21.6640	0.6921	1.1106	0.6435
1984Q4	8.3388	17.1513	17.5203	0.7666	1.2240	0.2717
1985Q1	7.9687	16.8236	13.3253	1.0901	1.1044	0.9320
1985Q2	7.6740	16.6779	22.1066	0.7658	1.1475	0.8004
1985Q3	7.6512	16.5348	21.5240	0.5792	1.1596	1.2133
1985Q4	7.7373	17.5504	19.2730	0.6847	1.2742	0.8080
1986Q1	7.5093	17.4939	15.9495	0.8301	1.4223	0.6055
1986Q2	7.3117	17.2728	22.8237	0.8368	1.0302	1.0344
1986Q3	7.3544	17.2004	23.1240	0.7703	1.1375	0.9621
1986Q4	7.4074	18.0911	19.4283	0.9786	1.2107	0.6520
1987Q1	7.4246	18.0311	15.1385	0.9430	1.1867	0.9088
1987Q2	6.9691	17.7944	22.6587	0.7864	1.2970	0.9102

Period	Whole Milk L	Low-Fat Milk L	Soft Drink L	Orange Juice Kg	Coffee & Tea Kg	Concentrated Milk Kg
1987Q3	7.0217	17.6754	25.4044	0.9794	1.1645	0.6888
1987Q4	7.1141	18.6511	20.9484	0.9201	1.4125	0.5324
1988Q1	6.8374	18.5531	18.4741	0.9400	1.3833	0.6638
1988Q2	6.7037	17.9133	24.1445	0.7144	1.1535	0.8099
1988Q3	6.6112	17.7267	25.9650	0.8446	1.0939	0.8389
1988Q4	6.6330	18.2517	18.2424	0.7869	1.2021	0.6733
1989Q1	6.2207	18.1161	17.4787	0.7792	1.1809	0.7338
1989Q2	6.0037	17.8536	24.7896	0.8522	1.1241	0.7513
1989Q3	5.9191	17.7442	28.0989	0.6769	1.1312	0.6715
1989Q4	6.0527	18.3421	24.7924	0.8796	1.3050	0.9408
1990Q1	5.7398	18.5542	15.1336	0.7735	1.2407	0.3141
1990Q2	5.4292	18.2088	21.4469	0.6012	1.3461	0.6738
1990Q3	5.2781	17.6892	23.4682	0.6845	1.2001	0.6427
1990Q4	5.4584	18.9644	19.8845	0.7034	1.2337	0.6996
1991Q1	5.2097	18.7080	17.1091	0.6939	1.3014	0.7310
1991Q2	4.9092	18.4155	21.8439	0.7365	1.2792	0.7761
1991Q3	4.8770	18.3444	25.2036	0.7358	1.1488	0.8013
1991Q4	4.9159	19.0064	20.5492	0.8753	1.4117	0.8698
1992Q1	4.7679	18.9953	17.8977	0.6560	1.3216	0.8500
1992Q2	4.5547	18.3872	24.4867	0.8333	0.9402	0.8637
1992Q3	4.5053	17.9955	22.8445	0.8953	1.2502	0.8917
1992Q4	4.5722	18.7230	21.4443	1.0010	1.3038	0.7365
1993Q1	4.4194	18.4873	18.5992	1.0039	1.3812	0.6713
1993Q2	4.1624	17.7963	23.3079	1.0244	1.2579	0.7193
1993Q3	4.2471	17.8168	24.9741	0.9597	1.2033	0.8497
1993Q4	4.3188	18.7379	20.8975	1.1223	1.3433	0.9067

Table 2. Quarterly Average Retail Prices For Fluid Milks and Related Beverages (1979Q1-1993Q4)

Period	Whole Milk L	Low-Fat Milk L	Soft Drink L	Orange Juice Kg	Coffee & Tea Kg	Concentrated Milk Kg
1979Q1	0.5259	0.5089	0.6610	1.5334	11.0078	1.3133
1979Q2	0.5371	0.5233	0.6892	1.6509	10.8424	1.3673
1979Q3	0.5510	0.5360	0.6858	1.5478	11.2033	1.4115
1979Q4	0.5724	0.5581	0.6959	1.6740	12.0605	1.4631
1980Q1	0.5910	0.5784	0.7343	1.6567	12.3763	1.5293
1980Q2	0.6105	0.5937	0.7873	1.7047	12.2259	1.6153
1980Q3	0.6263	0.6132	0.8482	1.7580	12.3011	1.6914
1980Q4	0.6514	0.6378	0.8696	1.6985	11.9853	1.7380
1981Q1	0.6876	0.6776	0.8967	1.8063	11.7146	1.7724
1981Q2	0.7053	0.6963	0.9249	2.1351	11.6244	1.8239
1981Q3	0.7211	0.7065	0.9655	2.1726	11.6996	1.8828
1981Q4	0.7369	0.7107	0.9474	2.2345	11.5041	1.9197
1982Q1	0.7554	0.7217	0.9598	2.2579	11.4590	1.9638
1982Q2	0.7657	0.7429	1.0230	2.3846	11.6695	2.0669
1982Q3	0.7722	0.7429	1.0151	2.3581	11.6996	2.0915
1982Q4	0.8019	0.7752	0.9384	2.4012	11.5342	2.1480
1983Q1	0.8121	0.7616	0.9880	2.4159	11.5041	2.1872
1983Q2	0.7889	0.7480	0.9802	2.3701	11.3838	2.2069
1983Q3	0.7991	0.7624	0.9474	2.3908	11.5642	2.2486
1983Q4	0.8084	0.7684	0.9350	2.3997	11.6394	2.2830
1984Q1	0.8400	0.8032	0.9824	2.4919	11.9703	2.3247
1984Q2	0.8623	0.8116	1.0129	2.8589	12.3462	2.3591
1984Q3	0.8660	0.8116	0.9880	2.9427	12.6018	2.3689
1984Q4	0.8837	0.8371	0.9362	2.9136	12.8876	2.3615
1985Q1	0.9106	0.8668	0.9756	3.0337	13.1432	2.3885
1985Q2	0.9162	0.8456	1.0106	3.1369	13.2334	2.3934
1985Q3	0.9190	0.8345	1.0896	3.1192	13.2786	2.4155
1985Q4	0.9227	0.8371	1.0704	2.9679	12.9176	2.4106
1986Q1	0.9227	0.8413	1.1381	2.7945	14.0305	2.4597
1986Q2	0.9264	0.8439	1.1302	2.5171	15.5944	2.4548
1986Q3	0.9329	0.8506	1.1279	2.4254	15.5944	2.4548
1986Q4	0.9357	0.8549	1.1166	2.4166	14.9177	2.4499
1987Q1	0.9394	0.8651	1.1866	2.5592	14.4816	2.5039
1987Q2	0.9422	0.8557	1.1505	2.6999	13.3838	2.4990
1987Q3	0.9469	0.8651	1.1414	2.5200	12.9327	2.5284
1987Q4	0.9552	0.8659	1.1223	2.7491	12.5116	2.5284

Period	Whole Milk L	Low-Fat Milk L	Soft Drink L	Orange Juice Kg	Coffee & Tea Kg	Concentrated Milk Kg
1988Q1	0.9599	0.8685	1.2125	2.0703	12.4064	2.5677
1988Q2	0.9794	0.8948	1.1933	2.0205	12.3612	2.5923
1988Q3	1.0017	0.9134	1.1617	1.9943	12.2710	2.6389
1988Q4	1.0035	0.9151	1.1392	2.0682	12.1206	2.6291
1989Q1	1.0091	0.9160	1.2046	1.8960	12.3161	2.6659
1989Q2	1.0110	0.9270	1.1877	1.8512	12.3913	2.6463
1989Q3	1.0119	0.9312	1.1843	2.0461	12.4214	2.6757
1989Q4	1.0258	0.9541	1.0704	1.8872	12.2710	2.6831
1990Q1	1.0361	0.9550	1.1561	3.1511	12.3612	2.7518
1990Q2	1.0268	0.9490	1.1764	3.3946	12.3612	2.8058
1990Q3	1.0416	0.9634	1.1493	3.3375	12.4214	2.8181
1990Q4	1.0621	0.9982	1.0693	3.2219	12.2109	2.8500
1991Q1	1.0677	0.9991	1.2023	2.9407	12.1507	2.9040
1991Q2	1.0732	0.9991	1.2091	2.8117	12.0304	2.9310
1991Q3	1.0779	1.0016	1.1911	2.7586	11.8800	2.9654
1991Q4	1.0807	0.9982	1.1302	2.5638	11.5492	2.9482
1992Q1	1.0816	0.9940	1.1200	2.5273	11.3236	2.9703
1992Q2	1.0853	0.9923	1.1121	2.5643	11.2334	3.0120
1992Q3	1.0900	0.9999	1.1234	2.3895	11.0379	3.0194
1992Q4	1.0900	1.0143	1.1493	2.2679	10.8574	3.0317
1993Q1	1.0667	1.0050	1.2023	2.1613	10.8274	3.0366
1993Q2	1.0537	0.9948	1.1978	1.9422	10.7823	3.0317
1993Q3	1.0546	0.9897	1.1888	1.8786	10.7973	3.0489
1993Q4	1.0556	0.9872	1.1764	1.9363	10.8274	3.0710

Table 3. Quarterly Per Capita Disappearance of Fats and Oils (1978Q1-1994Q1):

Period	Butter Kg	Margarine Kg	Shortening Kg	Cooking/Salad Oil Litre
1978Q1	1.2116	1.5208	0.2025	0.3806
1978Q2	1.0174	1.2071	0.1790	0.3441
1978Q3	1.0211	1.1615	0.2327	0.3727
1978Q4	1.2068	1.4637	0.2941	0.3249
1979Q1	0.9784	1.0370	0.1065	0.3629
1979Q2	0.9910	0.9379	0.1078	0.4095
1979Q3	1.0641	0.9783	0.1350	0.5134
1979Q4	1.3283	1.1123	0.1206	0.5397
1980Q1	0.9796	1.0842	0.1852	0.5726
1980Q2	1.1643	1.0315	0.1691	0.3417
1980Q3	1.1842	0.9065	0.1962	0.3799
1980Q4	1.0999	0.9211	0.2030	0.3842
1981Q1	1.0059	0.9445	0.1155	0.3902
1981Q2	1.0119	0.8880	0.1368	0.4235
1981Q3	1.1195	1.1909	0.1698	0.3669
1981Q4	1.1980	1.2297	0.2703	0.3833
1982Q1	0.9603	1.2310	0.1987	0.3770
1982Q2	1.0618	1.2348	0.0978	0.3938
1982Q3	1.0118	1.2404	0.2394	0.3955
1982Q4	1.1584	1.2783	0.2107	0.3915
1983Q1	1.0358	1.3414	0.1312	0.3802
1983Q2	1.0208	1.2627	0.2089	0.4305
1983Q3	0.9595	1.2384	0.2495	0.3862
1983Q4	1.2565	1.2091	0.2637	0.3683
1984Q1	1.0823	1.1623	0.1595	0.3965
1984Q2	0.9264	1.2617	0.1986	0.3994
1984Q3	0.9502	1.0878	0.2318	0.3766
1984Q4	1.2112	1.2993	0.2493	0.3662
1985Q1	1.0668	1.4590	0.1804	0.4025
1985Q2	0.8304	1.1843	0.1806	0.3361
1985Q3	1.0107	1.2432	0.2077	0.4004
1985Q4	1.0729	1.3165	0.2349	0.3000
1986Q1	0.8343	1.3010	0.1228	0.3765
1986Q2	1.0835	1.0467	0.1878	0.3103
1986Q3	1.0071	1.0962	0.1746	0.3324
1986Q4	0.8776	1.3530	0.2369	0.3356

Period	Butter Kg	Margarine Kg	Shortening Kg	Cooking/Salad Oil Litre
1987Q1	0.8688	1.3350	0.1160	0.3176
1987Q2	0.9509	1.0838	0.1246	0.3220
1987Q3	0.9334	1.0815	0.1507	0.3349
1987Q4	1.0397	1.1445	0.1741	0.4005
1988Q1	0.9010	1.2135	0.0851	0.3515
1988Q2	0.8914	1.0117	0.0935	0.3564
1988Q3	0.8804	1.0511	0.1393	0.3683
1988Q4	1.0243	1.2726	0.1956	0.3837
1989Q1	0.7982	1.1539	0.0987	0.3705
1989Q2	0.8587	1.0492	0.1026	0.3139
1989Q3	0.9085	1.0187	0.1630	0.2775
1989Q4	0.9103	1.1826	0.1747	0.3251
1990Q1	0.7063	1.1714	0.0936	0.3372
1990Q2	0.7862	1.1432	0.0825	0.3606
1990Q3	0.8314	1.1841	0.1502	0.3249
1990Q4	0.9491	1.2623	0.1901	0.3369
1991Q1	0.6378	1.1919	0.1596	0.3821
1991Q2	0.7661	1.1541	0.0956	0.3416
1991Q3	0.7175	1.1974	0.2090	0.2950
1991Q4	0.9223	1.2106	0.2621	0.3530
1992Q1	0.5339	1.1931	0.1517	0.3072
1992Q2	0.6561	1.1407	0.1339	0.3274
1992Q3	0.7430	1.0967	0.2934	0.3372
1992Q4	0.7722	1.0645	0.3536	0.3702
1993Q1	0.6211	1.1137	0.2325	0.4046
1993Q2	0.6405	0.9888	0.0784	0.2059
1993Q3	0.7807	1.0121	0.2111	0.3224
1993Q4	0.8299	1.1108	0.1641	0.4136
1994Q1	0.6058	1.0511	0.1666	0.4207

Table 4. Quarterly Average Retail Prices for Fats and Oils (1978Q1-1994Q1)

Period	Butter Kg	Margarine Kg	Shortening Kg	Cooking/Salad Oil Litre
1978Q1	2.7848	1.5166	1.4935	1.5602
1978Q2	2.8875	1.5210	1.4962	1.6302
1978Q3	2.9308	1.6291	1.5380	1.7520
1978Q4	2.9362	1.6379	1.5882	1.7727
1979Q1	3.0497	1.6533	1.6272	1.7883
1979Q2	3.1362	1.6643	1.6551	1.8401
1979Q3	3.2065	1.7084	1.7275	1.8712
1979Q4	3.2822	1.7657	1.7777	1.9023
1980Q1	3.4390	1.8054	1.8445	1.9334
1980Q2	3.5634	1.8230	1.8863	1.9956
1980Q3	3.6986	1.8341	1.8640	1.9179
1980Q4	3.8013	1.8539	1.8724	1.9360
1981Q1	3.8933	1.8848	1.9448	1.9645
1981Q2	4.0555	1.9068	1.9755	1.9645
1981Q3	4.2177	1.9200	1.9978	1.9593
1981Q4	4.2826	1.8826	2.0256	1.9671
1982Q1	4.4232	1.9024	2.0507	1.9568
1982Q2	4.4827	1.9267	2.0702	2.0034
1982Q3	4.5854	1.9267	2.1594	2.0267
1982Q4	4.6989	1.9553	2.1873	2.1019
1983Q1	4.7422	1.9597	2.2151	2.1200
1983Q2	4.7909	1.9421	2.1928	2.1200
1983Q3	4.9315	1.9377	2.2736	2.1226
1983Q4	4.9801	1.9994	2.3823	2.2263
1984Q1	5.0180	2.0854	2.5021	2.3662
1984Q2	5.1640	2.1471	2.4910	2.3507
1984Q3	5.2126	2.2816	2.5801	2.4984
1984Q4	5.2721	2.3808	2.5801	2.5347
1985Q1	5.2180	2.3896	2.6776	2.5529
1985Q2	5.2126	2.3786	2.7334	2.5295
1985Q3	5.2559	2.3675	2.7584	2.5425
1985Q4	5.3208	2.3499	2.7250	2.6202
1986Q1	5.3478	2.2661	2.7752	2.6228
1986Q2	5.3586	2.2154	2.7835	2.5969
1986Q3	5.4235	2.2066	2.8086	2.5710
1986Q4	5.4992	2.1295	2.7779	2.5814

Period	Butter Kg	Margarine Kg	Shortening Kg	Cooking/Salad Oil Litre
1987Q1	5.4992	2.1074	2.7807	2.5710
1987Q2	5.4884	2.1074	2.8170	2.5347
1987Q3	5.4992	2.0898	2.7417	2.5217
1987Q4	5.5046	2.0743	2.5328	2.4958
1988Q1	5.5479	2.1449	2.5634	2.5503
1988Q2	5.6128	2.2154	2.5439	2.5399
1988Q3	5.6506	2.2970	2.5745	2.5917
1988Q4	5.6398	2.4315	2.5328	2.6358
1989Q1	5.6398	2.4866	2.5240	2.7161
1989Q2	5.5479	2.4667	2.5192	2.6773
1989Q3	5.7047	2.5196	2.5121	2.7032
1989Q4	5.8183	2.5527	2.5121	2.6980
1990Q1	5.7912	2.5593	2.5049	2.6902
1990Q2	5.7426	2.5086	2.4761	2.6332
1990Q3	5.8291	2.5527	2.5001	2.6747
1990Q4	6.0291	2.5792	2.4737	2.7187
1991Q1	6.0400	2.5814	2.4617	2.7498
1991Q2	6.0454	2.5725	2.4521	2.7369
1991Q3	5.9859	2.5417	2.4521	2.7395
1991Q4	5.9697	2.4954	2.5216	2.6773
1992Q1	5.9426	2.4932	2.5456	2.7058
1992Q2	5.8886	2.5329	2.5456	2.7213
1992Q3	5.8994	2.4998	2.5504	2.7135
1992Q4	5.9264	2.5174	2.5936	2.7084
1993Q1	5.8507	2.5329	2.6320	2.6980
1993Q2	5.8237	2.5174	2.6368	2.6487
1993Q3	5.9534	2.5461	2.6464	2.7084
1993Q4	5.9480	2.5130	2.6536	2.7006
1994Q1	5.9534	2.5395	2.6728	2.7213

Table 5. Quarterly Per Capita Disappearance of Cheeses and Apparent Substitutes (1984Q4-1993Q4)

Period	Cheddar Cheese Kg	Other Cheese Kg	Eggs Dozen	Beef Kg	Pork Kg	Chicken Kg
1984Q4	0.7689	1.1600	3.7993	6.7958	6.4423	4.2315
1985Q1	0.9233	0.9770	3.3824	6.7154	6.3047	4.5973
1985Q2	1.0796	1.1890	3.3635	7.2133	6.3624	4.7183
1985Q3	1.0331	1.2287	3.5536	7.7314	6.2275	4.9176
1985Q4	0.9422	1.2278	3.6834	6.6667	6.3610	4.4752
1986Q1	0.8358	1.1768	3.2950	6.4877	6.2931	4.6443
1986Q2	1.0774	1.3254	3.4082	7.2545	5.8368	5.0388
1986Q3	1.2070	1.3197	3.5207	7.2898	5.6643	4.8971
1986Q4	0.9742	1.3451	3.6570	6.6068	6.4123	4.6806
1987Q1	1.0324	1.1726	3.2590	6.5984	6.3519	4.9341
1987Q2	1.0823	1.2687	3.3624	6.6005	5.6393	5.2428
1987Q3	1.0510	1.4485	3.3869	6.9876	5.9469	5.4040
1987Q4	0.9886	1.5342	3.5429	6.2426	6.2247	4.8847
1988Q1	1.0372	1.3298	3.3081	6.6056	6.3339	5.2489
1988Q2	1.0178	1.2626	3.2142	6.9103	5.7407	5.5033
1988Q3	1.0553	1.4073	3.2398	6.7380	6.2321	5.3554
1988Q4	0.9825	1.5925	3.3899	6.1484	6.4411	5.1120
1989Q1	1.1401	1.3851	3.0868	5.9772	6.4903	5.0358
1989Q2	1.0578	1.3970	3.1470	6.8523	6.2450	5.4507
1989Q3	0.9108	1.4487	3.1975	6.7003	6.1641	5.3792
1989Q4	1.0064	1.5011	3.2803	6.0469	6.2771	4.9657
1990Q1	0.7727	1.2470	3.0594	6.0702	6.2486	5.2340
1990Q2	1.0105	1.4277	3.0911	6.4549	5.6607	5.6540
1990Q3	1.0565	1.4178	3.1313	6.4579	5.2579	5.5126
1990Q4	0.9665	1.5509	3.2079	5.7410	5.8388	5.1899
1991Q1	1.0100	1.3351	2.9708	5.7457	6.0191	5.1896
1991Q2	0.9514	1.3855	3.0281	6.3457	5.5231	5.5802
1991Q3	0.9574	1.5162	3.1806	6.2858	5.5454	5.6671
1991Q4	0.8708	1.4621	3.2485	5.8328	6.1729	5.0601
1992Q1	0.8194	1.3136	2.9377	5.3130	6.2688	5.3465
1992Q2	1.0280	1.5214	2.9988	6.2370	5.7668	5.5186
1992Q3	0.9261	1.5147	3.0928	6.1640	6.0350	5.6418
1992Q4	0.8911	1.5247	3.1743	5.6734	6.6031	5.2049
1993Q1	0.8674	1.4598	2.9178	5.5269	6.3885	5.3963
1993Q2	0.9337	1.3277	3.0714	6.3794	5.5659	5.7772
1993Q3	0.9181	1.6313	3.0601	5.5225	6.1157	5.9757
1993Q4	0.9903	1.5902	3.2310	5.0753	5.7670	5.5542

Table 6. Quarterly Average Retail Prices for Cheeses and Apparent Substitutes (1984Q4-1993Q4)

Period	Cheddar Cheese Kg	Other Cheese Kg	Eggs Dozen	Beef Kg	Pork Kg	Chicken Kg
1984Q4	7.4283	8.0585	1.3670	5.6192	4.3308	3.0993
1985Q1	7.5371	7.9924	1.3564	5.7357	4.3358	2.9741
1985Q2	7.5526	8.0419	1.3391	5.7999	4.1802	2.9939
1985Q3	7.5216	8.0337	1.3351	5.6541	4.3559	3.1059
1985Q4	7.5682	8.0915	1.3298	5.6308	4.4061	3.0235
1986Q1	7.6537	8.1825	1.3351	5.7532	4.5566	3.0565
1986Q2	7.7314	8.2320	1.3272	5.6366	4.5867	3.0466
1986Q3	7.7935	8.2899	1.3232	5.7765	5.3846	3.4385
1986Q4	7.9023	8.3395	1.3272	6.1438	5.5402	3.6328
1987Q1	8.0189	8.4469	1.2926	6.1729	5.3345	3.5340
1987Q2	8.0655	8.4965	1.2727	6.3886	5.4148	3.4879
1987Q3	8.0810	8.5131	1.3059	6.4236	5.7409	3.4945
1987Q4	8.0732	8.5048	1.3046	6.4585	5.3746	3.4682
1988Q1	8.1354	8.6288	1.3192	6.4236	5.0534	3.4484
1988Q2	8.3141	8.7775	1.3179	6.4702	5.1137	3.4451
1988Q3	8.3996	8.8933	1.3458	6.4527	5.3897	3.7284
1988Q4	8.3685	8.8189	1.3896	6.4760	5.2341	3.5505
1989Q1	8.4462	8.9842	1.4162	6.5168	5.1287	3.7382
1989Q2	8.4540	9.0751	1.4082	6.6043	5.1638	3.8766
1989Q3	8.4384	9.0999	1.4481	6.6101	5.4449	4.1137
1989Q4	8.5084	9.2569	1.4640	6.6509	5.4047	4.0742
1990Q1	8.6249	9.3561	1.4494	6.7092	5.3997	4.1071
1990Q2	8.6094	9.3561	1.4401	6.8549	5.7409	4.1236
1990Q3	8.6016	9.3561	1.4773	6.8782	6.0069	4.1763
1990Q4	8.7259	9.5793	1.4919	6.9657	5.8865	4.2092
1991Q1	8.9202	9.7363	1.4773	7.0065	5.7108	4.1928
1991Q2	8.9357	9.7776	1.4707	6.9249	5.6004	3.9918
1991Q3	8.9824	9.7776	1.4534	6.8841	5.6707	4.0544
1991Q4	9.1222	9.8189	1.4454	6.7616	5.5051	4.0314
1992Q1	9.2155	9.9760	1.4188	6.7325	5.2391	4.0314
1992Q2	9.2621	10.0090	1.4215	6.8433	5.3043	3.9787
1992Q3	9.2621	9.9595	1.4388	6.7325	5.4649	4.0380
1992Q4	9.2388	9.9925	1.4574	6.9249	5.4097	4.1499
1993Q1	9.3242	9.9925	1.4149	7.0706	5.3043	4.2290
1993Q2	9.3942	9.9595	1.3936	7.1930	5.4599	4.1335
1993Q3	9.3476	9.9925	1.4056	7.2280	5.7761	4.0972
1993Q4	9.3942	10.0586	1.4228	7.2105	5.7209	4.0907

Table 7. Quarterly Per Capita Disappearance of Dairy Desserts (1984Q4-1993Q4)

Period	Ice Cream Kg	Yogurt Kg	Cottage Cheese Kg	Cream Kg
1984Q4	1.4608	0.4712	0.2769	2.0114
1985Q1	1.6222	0.5926	0.3128	1.7550
1985Q2	2.4979	0.6352	0.3595	1.9785
1985Q3	2.5139	0.5926	0.3370	2.0333
1985Q4	1.5541	0.5434	0.3064	2.2134
1986Q1	1.6464	0.6900	0.3140	1.9559
1986Q2	2.6774	0.7165	0.3481	2.0511
1986Q3	2.5978	0.6465	0.3151	2.1127
1986Q4	1.6352	0.6319	0.2737	2.2367
1987Q1	1.7035	0.8787	0.2897	1.8932
1987Q2	2.4945	0.8834	0.3160	2.1256
1987Q3	2.4231	0.8052	0.3081	2.1572
1987Q4	1.5299	0.7377	0.2658	2.2388
1988Q1	1.6220	0.8989	0.2906	1.9448
1988Q2	2.5532	0.8866	0.3020	2.0595
1988Q3	2.4724	0.8647	0.3023	2.0785
1988Q4	1.5550	0.7732	0.2631	2.2788
1989Q1	1.5425	0.8754	0.2784	1.9157
1989Q2	2.4804	1.0224	0.2962	1.9921
1989Q3	2.2617	0.8264	0.2849	2.0559
1989Q4	1.5007	0.7498	0.2456	2.1077
1990Q1	1.4775	0.9037	0.2622	2.0053
1990Q2	2.4219	0.8396	0.2802	2.1218
1990Q3	2.3797	0.8184	0.3203	2.1155
1990Q4	1.4293	0.7300	0.2532	2.2589
1991Q1	1.4366	0.8536	0.2640	1.9326
1991Q2	2.4061	0.8743	0.2712	2.0633
1991Q3	2.2550	0.7550	0.2616	2.0364
1991Q4	1.4035	0.7073	0.2349	2.1858
1992Q1	1.4256	0.8368	0.2365	1.9251
1992Q2	2.1752	0.8245	0.2489	2.0725
1992Q3	1.9261	0.7927	0.2218	2.1249
1992Q4	1.3179	0.6547	0.2158	2.2123
1993Q1	1.4715	0.8720	0.2197	1.9326
1993Q2	2.2952	0.8398	0.2364	2.0804
1993Q3	2.2395	0.7791	0.2191	2.0936
1993Q4	1.3450	0.7300	0.2170	2.1373

Table 8. Quarterly Average Retail Prices for Dairy Desserts (1984Q4-1993Q4)

Period	Ice Cream Kg	Yogurt Kg	Cottage Cheese Kg	Cream Kg
1984Q4	1.2834	2.9227	3.5949	2.7993
1985Q1	1.2970	2.9075	3.5949	2.7993
1985Q2	1.2848	2.9714	3.6212	2.8082
1985Q3	1.2725	2.9745	3.5799	2.8289
1985Q4	1.3323	3.0141	3.6813	2.8999
1986Q1	1.3567	3.0232	3.7226	2.9118
1986Q2	1.3472	3.0262	3.7301	2.9295
1986Q3	1.3445	3.0628	3.7564	2.9680
1986Q4	1.3812	3.0597	3.8240	3.0301
1987Q1	1.3771	3.1267	3.8390	3.0301
1987Q2	1.3635	3.1115	3.8503	3.0331
1987Q3	1.3744	3.1846	3.8691	3.1159
1987Q4	1.3662	3.1358	3.9104	3.1485
1988Q1	1.3920	3.2728	3.9968	3.1781
1988Q2	1.4206	3.3185	4.0419	3.2550
1988Q3	1.4301	3.3155	4.0832	3.2165
1988Q4	1.4219	3.2546	4.1133	3.2106
1989Q1	1.4450	3.3764	4.1320	3.2461
1989Q2	1.4219	3.3794	4.1696	3.3438
1989Q3	1.4396	3.3977	4.1846	3.3527
1989Q4	1.4613	3.3824	4.2785	3.4059
1990Q1	1.4925	3.5134	4.2823	3.4237
1990Q2	1.4776	3.4768	4.2297	3.4355
1990Q3	1.4803	3.4799	4.2635	3.4710
1990Q4	1.4858	3.5438	4.3386	3.5568
1991Q1	1.5469	3.5468	4.3612	3.5864
1991Q2	1.5346	3.5347	4.2560	3.6101
1991Q3	1.5116	3.5225	4.1959	3.6279
1991Q4	1.5306	3.5560	4.2335	3.6870
1992Q1	1.5863	3.5651	4.2823	3.6900
1992Q2	1.5822	3.5164	4.2748	3.6989
1992Q3	1.5672	3.4738	4.2635	3.7018
1992Q4	1.5632	3.4494	4.1959	3.7048
1993Q1	1.5564	3.4646	4.1283	3.7078
1993Q2	1.5143	3.4555	4.1320	3.7373
1993Q3	1.5088	3.4403	4.1809	3.7373
1993Q4	1.5238	3.3824	4.1508	3.7936

Table 9. Data for Skim Milk Powder and Food Including Non-alcoholic Beverages (1984Q4-1993Q4)

Period	(1)*	(2)*	(3)*	(4)*
1984Q4	0.9682	5.0263	318.0762	92.8321
1985Q1	0.2095	5.1938	296.8437	94.6407
1985Q2	0.4670	5.2479	320.3327	95.8150
1985Q3	0.5315	5.2371	317.9064	95.3962
1985Q4	0.5668	5.2965	330.8400	94.6344
1986Q1	0.4543	5.3668	305.0102	97.5340
1986Q2	0.1911	5.3776	338.7436	99.0819
1986Q3	0.7158	5.4046	337.8505	100.9464
1986Q4	0.3446	5.4749	353.3273	102.2002
1987Q1	0.4029	5.5127	319.7833	103.7411
1987Q2	0.4437	5.5181	354.3885	104.7140
1987Q3	0.6226	5.5830	355.3322	104.9855
1987Q4	0.5058	5.5938	371.8881	104.5469
1988Q1	0.4504	5.6316	332.7105	105.5721
1988Q2	0.5907	5.7019	359.2097	106.3446
1988Q3	0.5485	5.7721	364.1596	108.1493
1988Q4	0.3600	5.7667	378.8170	106.9996
1989Q1	0.3071	5.7829	339.3572	108.6095
1989Q2	0.5878	5.8154	374.7344	110.2094
1989Q3	0.6841	5.8802	376.4888	111.0297
1989Q4	0.6846	5.9451	386.8974	109.9835
1990Q1	0.3822	6.0099	356.3720	113.9147
1990Q2	0.3618	6.0910	386.7533	113.9010
1990Q3	0.4101	6.0856	385.5620	114.9431
1990Q4	0.3568	6.1937	395.3243	114.3568
1991Q1	0.3821	6.2585	363.0191	117.1033
1991Q2	0.2977	6.2747	394.2593	119.0240
1991Q3	0.1974	6.2693	387.2702	117.8189
1991Q4	0.4042	6.3612	394.8398	113.6174
1992Q1	0.1996	6.4369	356.2449	114.4413
1992Q2	0.3377	6.4747	386.9497	115.6954
1992Q3	0.3299	6.4855	381.9621	115.6343
1992Q4	0.3045	6.5234	398.5644	115.0639
1993Q1	0.2498	6.5288	359.8331	117.2562
1993Q2	0.3314	6.6260	393.4389	117.6782
1993Q3	0.3318	6.6801	395.0865	117.3320
1993Q4	0.3587	6.7558	407.2942	117.1038

*Notes: (1). Quarterly per capita disappearance of skim milk powder (kg), (2). Average retail price of skim milk powder, (3). Per capita expenditure of food including non-alcoholic beverages in current value, (4). Consumer Price Index for food and non-alcoholic beverages, 1986=100.