UNIVERSITY OF ALBERTA

HOUSEHOLD DEMAND FOR NON-ALCOHOLIC BEVERAGES IN CANADA

BY

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ABSTRACT

This thesis studies the household demand for non-alcoholic beverages in Canada, using Canadian Family Food Expenditure Survey data for 1996 and 2001. Informational variables, such as generic milk advertising expenditures, milk brand advertising expenditures, and various types of beverage health information indices, and demographic variables are incorporated into the beverage demand systems, in order to uncover the factors that influence consumers' beverage consumption patterns.

Two forms of beverage demand system were estimated to examine the non-alcoholic beverage consumption. One is a flexible (*Lewbel, 1989*) general beverage demand system with the five major beverage types included in the model. The other is a blockwise dependent beverage demand system with the three types of milk disaggregated as individual expenditure shares.

The results indicate that informational variables are influential in consumers' beverage purchasing decisions. Milk generic advertising expenditures were successful in increasing consumer demand for fluid milk. Health information, which is consistent and based on sound scientific evidence, may change consumers beverage consumption, as they become increasingly health conscious. Results by sub-samples with different demographic characteristics provide useful information for developing marketing strategies as well.

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List of Abbreviations

Abbreviation	Name/Organization
AIDS	Almost Ideal Demand System
AIDADS	An Implicitly Directly Additive Demand System
BSE	Bovine Spongiform Encephalopathy
CJD	Creutzfeldt - Jakob disease
COP	Cost of Production
CPI	Consumer Price Index
CSFII	Continuing Survey of Food Intake by Individuals
CSPI	Centre for Science in the Public Interest
DFO	Dairy Farmers of Ontario
FAO	Food and Agriculture Organization
FFES	Canadian Family Food Expenditure Survey
LAIDS	Linear Almost Ideal Demand System
LFS	Labour Force Survey
MAIDS	Modified Almost Ideal Demand System
NFCS	National Food Consumption Survey
NPHS	National Population Health Survey
PETA	People for the Ethical Treatment of Animals
QUAIDS	Quadratic Almost Ideal Demand System
RSDAIDS	Restricted Source-Differentiated Almost Ideal Demand System
SHS	Survey of Household Spending
TM	Trade Mark
USDA	United States Department of Agriculture
WHO	World Health Organization

Chapter 1 Introduction and Background

Healthy drinking is part of a healthy eating pattern highly promoted by governments and health organizations to help Canadians form a healthy lifestyle. The consumption trends for non-alcoholic beverages clearly show that fluid milk consumption has been decreasing, while soft drinks and fruit juices have experienced growing demand since the 1980's (Figure 1.1). At the same time, consumers have switched from whole milk to partly skimmed and skimmed milk (Figure 1.2). Increasing consumer health concerns about beverage consumption, advertising campaigns, changing consumer demographics, and relative prices may be driving demand for non-alcoholic beverages in Canada. The objective of this study is to estimate a demand model for non-alcoholic beverages in order to uncover how these factors have influenced consumers' purchasing decisions on beverages. An introduction to the research initiative and a research outline for this thesis is provided in this chapter to follow.

1.1 Consumption Trends for Fluid Milk and Other Non-Alcoholic Beverages in Canada

Consumer trends for fluid milk and other non-alcoholic beverages include: first, decreasing consumption of fluid milk with higher fat content and increasing consumption of skimmed and partly skimmed fluid milk products; second, decreasing consumption of fluid milk and increasing consumption of other non-alcoholic beverages such as soft drinks, fruit juices, and bottled water.

According to Statistics Canada, the total per capita consumption of fluid milk (including 3.25% milk, 2% milk, 1% milk, skim milk, chocolate milk and buttermilk) has decreased 15.55% from 103.03 litres in 1980 to about 87 litres in 2001. Canadians also have reduced their consumption of milk with high fat content, such as whole milk (3.25% fat content) by almost two thirds during the past two decades. These changing consumption trends for fluid milk may result from the increasing consumer concerns over fat in milk. According to the National Population Health Survey (NPHS), conducted by Statistics Canada 1994/1995, many people (68% of the respondents) were concerned about the fat in foods they eat, and were taking steps to change their eating habits to reduce fat consumption. The most frequently mentioned steps included using fewer high-fat milk products, using more low-fat products and using less butter, oil, and salad dressing. Canada's Food Guide also suggests that people choose lower-fat dairy products (Health Canada, 2004).

On the other hand, the competing non-alcoholic beverages, such as packaged fruit juices, soft drinks, and soymilk, have seen rising consumption over the past two decades. The development of new technologies has provided consumers with a wider range of beverage choices. Consumers are eager to try new and innovative non-alcoholic beverage products. Per capita consumption of carbonated soft drinks has increased by 90%, from 59.6 litres in 1975 up to 113 litres in 2001. In 2000, per capita consumption of fruit juices was 26.51 litres, which increased 206.12% from 8.66 litres in 1970 and increased 23.26% from 21.42 litres in 1980. As a milk substitute, soy and rice beverages have had significant development in the past decade as well. On November 29, 1997, Health Canada approved for sale fortified plant-based beverages. With this regulation change, some of the soy beverage processors have been able to make soy beverage nutritionally equivalent to cow milk through product fortification with vitamins and minerals.

ACNielsen data (*as cited in Agriculture and Agri-Food Canada website*[1]) shows that the sales of soy and rice beverages have increased more than 300%, from annual sales of $12 million in 1997 to $52 million in 2001.

1.2 Possible Factors that Drive Non-Alcoholic Beverage Demand in Canada

Several factors that may be driving Canadian consumers' non-alcoholic beverage demand include consumers' health concerns about consumption of different beverage types, industries' advertising campaigns, changes in consumer demographics, relative prices and the development of the food away from home market.

Health Concerns Related to Non-alcoholic Beverage Consumption

Healthy eating promoted by governments is one of the most significant trends that influence the food industry today and in the foreseeable future. The media coverage of the relationship between food consumption and human health has been increasing significantly in recent years. Positive health effects may boost consumer demand for certain products, while negative health concerns may hinder consumers' purchasing intention for foods.

Generally milk is seen as a good food and an excellent source of calcium, which is beneficial for bone health. However, there is some negative health information about milk consumption. For example, many people are intolerant of or allergic to lactose, a sugar contained in milk. Certain milk products are high in saturated fat, which is a risk factor for heart disease. High Calcium diets have been perceived as a risk factor for prostate cancer as well (*Harvard School of Public Health, 2003*).

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[1] http://ats-sea.agr.gc.ca/us/e3219.htm (accessed January 5, 2005).

Soft drinks are accused of being one of the reasons for rising child obesity, since most soft drinks contain a large amount of sugar providing unnecessary excess calories in the diet. Children who consume soft drinks instead of milk or Calcium fortified beverages may have lower Calcium intakes and increased risk of osteoporosis and tooth decay (*as cited in a report of Dietitians of Canada, 2004*). Fruit and vegetable juices provide many vitamins and nutrients which prevent heart disease and cancer and when fortified serve as an excellent source of Calcium.

Industry Advertising Campaigns

Advertising and promotion campaigns are common strategies conducted by the dairy industry and other non-alcoholic beverage industries to sustain and improve their market shares. This group is the most heavily advertised industry group in the Canadian economy. In 2001, the Canadian dairy industry's total fluid milk advertising expenditure was more than $24 million. The generic fluid milk advertising expenditure, which was more than $21 million, accounted for more than 80% of the total expenditure. Promotions for branded milk products are carried out by individual manufacturers. Almost $3 million was spent in branded fluid milk advertising in 2001. The soft drink industry as a whole spent more than $29 million on advertising and promotion in 2001. The biggest two spenders are Coca-cola and Pepsi, with their expenditures being $18 million and $8 million respectively. The fruit juice industry is another big investor in promoting their products, with $16 million spent on advertising in 2001 (Figure 1.3).

The dairy industry is the fourth largest sector of the Canadian agriculture and agri-food economy next to grains, red meat and horticulture. In 2001, dairy farming generated $4.2 billion in total net farm cash receipts. During the same period, sales from Canadian dairy processors totaled $9.8 billion, accounting for 15% of all sales of processed food in the food and beverage industry in Canada. Canada's dairy sector operates under a supply management policy framework, which was established to balance milk production from all farms with domestic consumption of dairy products, taking into account imports and exports as well.

Generic promotion complements brand promotion conducted by processors and highlights the qualities of particular dairy products. Canada is a world leader in this type of promotion. Fluid milk, butter and cheese have been the main products targeted by these generic advertising and promotion campaigns. The cost of the generic promotion is included in the cost of production pricing formula of dairy products. The promotion of fluid milk is conducted by the provincial marketing agencies. Among all the provinces, Ontario and Quebec are the biggest spenders on this type of campaigns. For example, since August 1, 2001, $1.10 has been deducted per hectoliter to help finance provincial fluid milk promotion programs in Ontario. In 2001, $24.6 million was collected for milk promotion, and $14.3 million was spent by the Dairy Farmers of Ontario (DFO) on fluid milk promotion (*DFO Annual Report, 2001*). Marketing activities relating to industrial dairy products are carried out across the country and are handled by the national dairy producer organization, Dairy Farmers of Canada (*Canadian Dairy Commission, 2004*).

Changing of Canadian Demographics

Socioeconomic and demographic changes, such as the changing nationality of immigrants and the increasing aging population, also affect food consumption. In the past

20 years, Canada has become more ethnically diverse, in terms of both the number of Canadians whose nationality is not Canada, and the population growth coming from non-European countries (who largely were the source of previous immigration). Asia has become the major source of immigrants to Canada. In 1960, 79.44% of the immigrants were from European countries, only 4.05% of the immigrants were from Asian countries. However, in 2000, more than 60% of the immigrants were from Asian countries, and only 18.9% of the immigrants came from European countries. The fact that traditional Asian diets rarely include dairy products and 90% of Asian people are lactose intolerant (*Harvard School of Public Health, 2004*) may contribute to the decreasing per capita milk consumption in Canada.

The baby boomer is also an important demographic group affecting food demand. As they age, baby boomers expect more and more health benefits from food and have launched the healthy eating trend. These demographic changes are forcing companies to become more active in the development of new products, to renew the range of products and to better serve the market.

Price and Income Effects

Price differences between beverage types and income effects are important factors that influence people's beverage demand. An overall picture of food prices can be seen from the Statistics Canada Consumer Price Indexes (CPIs, 1992=100). In 2000, the CPI for general food items is 112.2, the CPI for dairy product is 111.8, and the CPI for non-alcoholic beverages is 98.7. Consumers always pursue optimal utility with lower prices.

The price and income effects could partly explain the changing consumption patterns of fluid milk and other non-alcoholic beverages.

Development of Food Away From Home

The development of food away from home may be another potential factor affecting beverage consumption. Over the past 15 years, a wider variety of convenience food, prepared meals and snacks (including milk products) has become available to consumers. The consumption of table milk eaten at home might be negatively influenced by the development of the sales of milk products marketed through food service channels. Overall milk consumption could be down due to the prevalence of other beverages in restaurants and lack of presence of milk.

1.3 Research Problem

Dietary and lifestyle patterns have changed dramatically in Canada. Increased consumption of energy-dense diets and decreased physical activity have had significantly negative impacts on the health and nutritional status of the population, and have led to nutrition related chronic diseases. Such chronic diseases as obesity, diabetes, certain forms of cancer, cardiovascular disease, and bone fractures have been significantly increasing, placing additional burdens on already overtaxed national health budgets (*FAO/WHO Expert Consultation Report, 2003*). In Canada, studies show that about 46 percent of the population is overweight and that obesity costs the health-care system almost $2 billion a year (*Edmonton Journal, March 4, 2003*).

Canada has taken steps such as publicly-funded health education campaigns and mandatory nutrition labeling to improve Canadians' dietary quality. Recently, the Centre for Science in the Public Interest (CSPI) is calling for "a comprehensive reform program" to prevent the chronic diseases related to poor diet and inactivity in Canada. The proposed program includes prohibiting advertising for "junk food" and video games directed at children and conducting intensive mass media campaigns to promote nutrition and physical activity.

Milk provides the most readily available source of calcium, which is needed to build and maintain strong bones and teeth. The suggested amount of milk products in Canada Food Guide for adults has increased from 0.5 pint/day in 1942 to 2-4 servings/day in 1992, and the suggested amount of milk products for children has also increased from more than 1 pint/day in 1942 to 2-3 servings/day in 1992 (*Health Canada, 2004*). According to the Dietitians of Canada, the calcium intake goal for healthy adults is approximately 1,000 milligrams (mg) every day, and older adults over the age of 50 should aim for an intake of 1,200 mg daily. However, concerns have been raised over calcium intake because of its relation to bone health. For example, about 60% of girls aged 13 to 17 years are reported not meeting the recommended amount of milk products (*Starkey et al. 2001*). The increasing consumption of soft drinks might lead to excessive energy intake, which may cause obesity.

Healthy eating has frequently appeared of the forefront of media coverage. Many newspapers and TV networks contain a health and wellness section. On a daily basis consumers are immersed with issues range from new drug advertisements to what people should eat in their diet. Health information on milk consumption is controversial. Milk is often seen as a nutritional food that is good for human health, and it has tremendous opportunities in the healthy beverage market. However, anti-milk groups argue that milk is not a suitable food for humans from the perspective of either animal welfare or certain nutrient content (e.g. fat) in milk. Health information on other beverages, such as fruit juices, vegetable juices and soft drinks, can not be isolated from the investigation of milk consumption as well.

Every year the commodity boards for fluid milk and other non-alcoholic beverage companies spend a significant amount of money on advertising to keep or increase the consumer demand for these products. Industry promotion campaigns are trying to build their products into the consumer's lifestyle. How do different sub-groups respond differently to advertising and various types of health information? Does milk advertising have an influence on consumers demand decisions? Have the fluid milk advertising and health information contributed to Canadian consumers' healthy eating, especially children, low-income and low-educated people? One purpose of this thesis is to provide answers to these questions. The using of cross-sectional data allows us to disaggregate the response of different consumer sub-groups to changes of prices and information flows.

From the perspective of both the industry and the government, there are several key problems in policy determination in relation to promotion of healthy eating and healthy lifestyle. For example, what market should be targeted, what the advertising should say, which media should be employed and how much to spend (*Doyle and Fenwick, 1975*). Managers are concerned about more and more detailed descriptions of their customers in order to make more efficient and effective use of their marketing budgets (*Richards, 2000*). The marketing strategies and targets are always related to different advertising responses of different segments of consumers, and different consumer subgroups, which have different socioeconomic characteristics. It is the researchers' task to find if there is a reliable way of estimating the demand decision and the advertising responsiveness.

1.4 Previous Studies

The observed consumption trends for fluid milk and other non-alcoholic beverages have motivated researchers to conduct consumer studies for these products in the U.S., Australia, Japan and European countries. A variety of factors that affect the demand for beverage products are identified, such as prices, demographic changes, increased consumers' concerns over fat intake and the structural changes in beverage consumption (*Gould et al. 1990*; *Xiao et al. 1998*). With the increasing level of milk generic advertising, a large number of studies have focused on the response to advertising in milk consumption or sales (*Chung and Kaiser, 2002*; *Lenz et al. 1998*). These studies reveal that generic advertising has more or less influenced milk consumption. Other studies examined the advertising effectiveness on other non-alcoholic beverage demand as well (e.g. *Rickertsen and Gustavsen, 2002*).

These studies have been typically conducted using aggregate time series data or disappearance data. In such studies, it is assumed that the choices of heterogeneous consumers can be represented by the choice of one representative, consumer who is a standard utility maximizing individual. Thus, the econometric model is derived from the utility maximization problem of a representative consumer, and then, typically, model estimation is conducted using aggregate data from groups of households and stores (*Chung and Kaiser, 2002*). However, a large literature indicates that this type of modeling may provide misleading conclusions since the aggregate data cover the heterogeneity of individual demands (*Manchester, 1977*). The use of household-level microdata can avoid the problem of aggregation over consumers and provides a large and comprehensive statistical sample (*Heien and Wessells, 1990*). *Yen and Lin (2002)* investigate milk, soft drink and juice consumption for children and adolescents in the U.S. They found that displacement of milk by soft drinks as a child or adolescent grows older. Income, TV watching, gender, race, and other demographic variables also play significant roles in determining beverage consumption. Yet the applications of these methods in agri-food demand still remain scanty.

In Canada, the dairy products demand studies date back to the 1970's (*Hassan and Sahi, 1976*). Since the dairy industry is supply managed and a per-unit levy is set in the cost of production formula, a large proportion of the dairy advertising research has focused on the optimal generic advertising decision and the changes in social welfare due to the generic advertising expenditure.

Another focus of previous studies (*Kinnucan, 1978*; *Venkateswaran and Kinnucan, 1990*; *Goddard and Cozzarin, 1992*; *Goddard and Tielu, 1988*; *Kinnucan and Belleza, 1991*; *Goddard, 1992*) is evaluation of the effectiveness of generic milk advertising. *Goddard et al. (1992)* analyzed the generic fluid milk advertising effect in Ontario, using a Translog demand system and incorporating soft drinks, tomato juice, orange juice and apple juice. They found that milk advertising significantly affects the demand for milk and other beverages. Advertising conducted by the Ontario Milk

Marketing Board appears to have increased milk demand sufficiently to offset the costs of the program. *Reynolds (1991)* analyzed the consumer choice of fluid milk consumption based on 1986 Family Food Expenditure Survey data. This study focused on the impact of the socioeconomic and demographic factors on the likelihood of households choosing fat-reduced milk over standard milk. Advertising was also introduced as an explanatory variable in the consumption of both standard and lowfat milk in these studies. Results from the estimation indicate that the impact of several of the socioeconomic and demographic variables were not homogeneous across different types of milk. Advertising affects the fluid milk items differently as well. Standard milk exhibits a significant unitary positive advertising elasticity, while lowfat and skim milk advertising elasticities are insignificantly negative.

Not much published research has been done on information effectiveness studies in Canada in recent years. This study directly complements other studies in examining household consumption patterns for milk and other non-alcoholic beverages and the impacts of various informational variables on demand by using cross-sectional survey data. As well, this study is the first one that has looked at media influences on beverage demand, beyond advertising.

1.5 Thesis Objectives

The general objective of this study is to provide a better understanding of the determinants of the Canadian households' purchasing decisions on fluid milk and other non-alcoholic beverages. Four specific objectives are defined as follows:

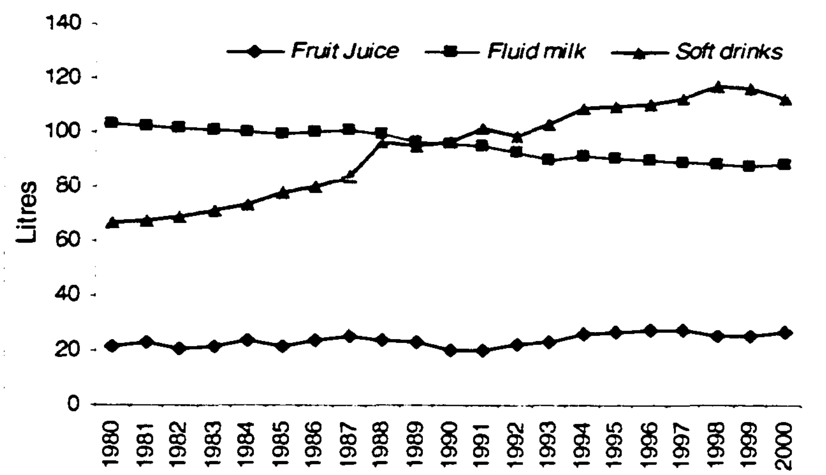
1. To describe the household demand for fluid milk and other non-alcoholic beverages in Canada, and analyze the influence of consumers' demographics on beverage demand;
2. To examine the effectiveness of various informational variables such as generic and brand advertising and health information on beverage demand;
3. To recognize different demand characteristics for disaggregated product types, especially different types of milk;
4. To develop social and marketing implications from 1, 2 and 3 for the Canadian dairy industry.

In order to answer the research problems and complete the study objectives, this thesis will apply economic theory and econometric techniques to construct a complete non-alcoholic beverage demand system using Canadian Family Food Expenditure Survey (FFES) data as well as the advertising expenditure data and health information indices. The samples of 1996 and 2001 will be used to investigate the consistency in conclusions that may be made from results obtained from using different datasets.

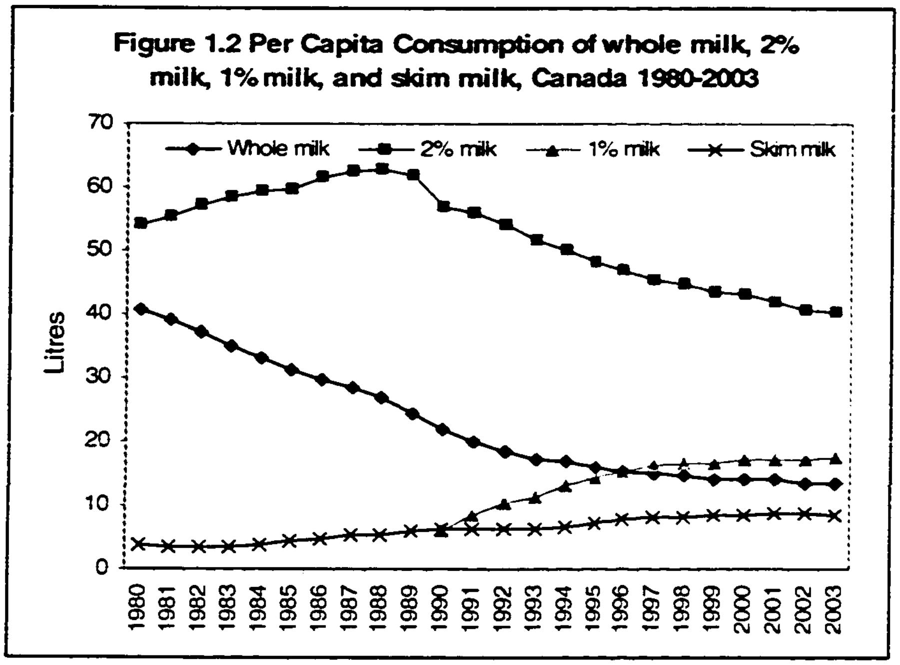
1.5 Thesis Outline

This thesis is composed of six chapters in total. The previous studies that are related to the non-alcoholic beverage demand analysis will be completely reviewed in Chapter Two. In Chapter Three, the theoretical framework used for this study is developed based on studies reviewed in Chapter Two. In Chapter Four, the data used in this study, including FFES consumption data, advertising data and health information indices, will be discussed. A comprehensive report of the demand model estimation results will be given in Chapter Five. The final chapter will summarize the thesis, discuss the study limitations and define the potential areas for further research.

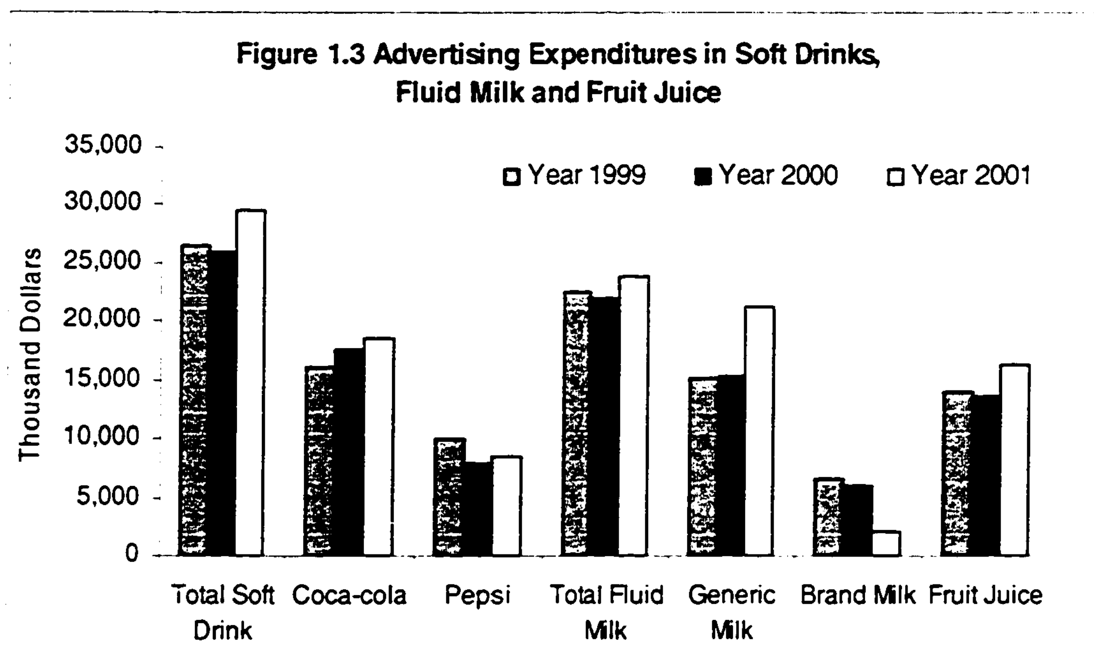
Figure 1.1 Per Capita Consumption of Fluid Milk, Fruit Juice and Soft Drinks, Canada 1980-2000



Data source: Compiled from Apparent Per Capita Food Consumption in Canada, Annual, 2002 (Statistics Canada).



Data source: Compiled from Apparent Per Capita Food Consumption in Canada, Annual. 2003 (Statistics Canada).



Data source: ACNielsen estimated media advertising data, 2001.

Chapter 2 Literature Review

2.1 Introduction

In order to find an appropriate technique to estimate milk and other non-alcoholic beverage demand for Canada, and to measure the effects of various informational variables, such as advertising expenditures and health information, a complete overview of consumer demand theory and empirical demand studies is reviewed in this chapter.

First, consumer demand theory, the demand model specifications, time series versus cross sectional data and the problems with the cross-sectional data estimation will be reviewed. Second, the integration of advertising expenditures and other information variables into demand functions and the empirical studies on advertising effectiveness will be discussed. Third, the empirical work on non-alcoholic beverage demand will be reviewed. At the end of this chapter, the criteria of method selection for this thesis will be summarized.

2.2 Consumer Demand Theory

In the basic consumer demand theory, the consumer is modeled as choosing the most preferred consumption bundles allowed by his/her budgets (*Deaton and Muellbauer, 1980; Binger and Hoffman, 1998*). This preference relationship between the consumption bundles is required to satisfy six axioms which indicate rational consumer behavior and facilitate the maximization procedure.

The six axioms include:

a) Completeness: the consumer can rank all pairs of consumption bundles either as one preferred to the other or as one indifferent to the other.

b) Reflexivity: two identical consumption bundles are always ranked the same.

c) Transitivity: the consumer's choices are consistent.

d) Continuity: the utility function is differentiable to the first and second degree.

e) Non-satiation: the bundle with more goods is always preferred to the bundle with less.

f) Convexity: diminishing marginal rates of substitution among indifferent commodity bundles.

Under the above assumptions, the consumer choices are represented by an ordinal utility function, which can be expressed as:

(2.1) Maximize $U = U(X)$ subject to $M = \sum_{i=1}^{n} p_i x_i$ $\quad i = 1, 2, \ldots, n,$

where M is the consumer's income or total expenditure, p_i is the price of the ith commodity and x_i is the quantity of the ith commodity. The consumer's constrained utility maximization problem can be solved by setting up the Lagrangian function and solving for the first order condition. The result gives the income-consumption relationship with quantity demanded as a function of income or total expenditure and prices:

(2.2) $x_i = f_i(M, p)$ $\quad i = 1, 2, \ldots, n.$

These functions are general forms of the Marshallian demand functions for a commodity. The maximum attainable utility given p and M is defined as the indirect utility function, which is given by:

(2.3) $V_i = V_i(M, p)$ $i = 1, 2, \ldots, n.$

The consumer problem can also be reformulated as one of selecting goods to minimize the expenditure necessary to reach a certain utility level. The problem is described as:

(2.4) Minimize $M = \sum_i p_i x_i$ subject to $U = u$ $i = 1, 2, \ldots, n,$

where u is the maximum attainable utility level in the original problem. By solving the new problem, we have the solution as a function of u and p,

(2.5) $x_i = h_i(u, p)$ $i = 1, 2, \ldots, n.$

These cost-minimizing demand functions are known as Hicksian or compensated demand functions. The maximization and minimization problems are often described as "dual" problems. The optimal commodity quantities in both cases are the same, which is given by

(2.6) $x_i = f(x, p) = h(u, p).$

We can also use derivative properties to generate demand functions. If the indirect utility function is specified, Roy's identity allows derivation of the demand functions from the indirect utility: $x = -(\partial V/\partial p)/(\partial V/\partial M)$. Sheppard's lemma allows derivation of demand functions from cost functions: $\partial C/\partial p = h(p, u) = h[p, V(p, M)]$.

Consumers maximize utility by allocating income so that the extra utility or marginal utility (mu) obtained from spending the last dollar on each good is the same. Hence, for all i and j, utility is maximized if

$$\text{(2.7)} \quad \frac{mux_i}{px_i} = \frac{mux_j}{px_j}, \text{ for all } i, j = 1, 2, \ldots, n.$$

These relationships provide general characteristics of the properties of Hicksian and Marshallian demand functions, which are summarized as follows:

1) Adding-up: The total value of both Hicksian and Marshallian demands is total expenditure;

2) Homogeneity: The Hicksian demands are homogenous of degree zero in prices, the Marshallian demands are homogenous of degree zero in total expenditure and prices;

3) Symmetry: The cross-price derivatives of the Marshalian and Hicksian demands are symmetric, for all $i \neq j$;

4) Negativity: The n by n matrix formed by the elements $\partial h_i / \partial p_i$ is negative semidefinite.

2.3 Demand Model Specification

Theories about demand model specification will be discussed in this section, including the selection between the single equation and the demand system approach, weak separability, and choice of demand models.

2.3.1 Single Equation versus Demand System

Economists have used different ways to measure the quantitative links between dependent variables and explanatory variables. The single equation method is used to relate demand of a good to a selected set of relevant prices and income or total expenditure. Prices of all other goods are taken into account by building the Consumer Price Index (CPI) into the demand function. For the single equation approach, it is normal to select some closely related commodities and account for their price effects as well as the CPI for all other prices in the same equation. Single equations have the advantage of simplicity and also provide more flexibility in equation specification (e.g. *Kinnucan, 1987*; *Venkateswaran and Kinnucan, 1990*).

However, the single equation approach has some disadvantages. First, the single equation approach is not generally consistent with demand theory in that it does not satisfy integrability conditions. That is, a single equation approach can not be directly related to utility maximization, and single good demands are not constrained by the budget constraint through the adding-up condition, which requires that expenditure shares for all goods add up to one. Second, the single equation approach does not apply cross-equation restrictions (e.g. Slutsky symmetry) on parameters to ensure that relationships among cross-price responses are consistent with demand theory. Finally, cross-commodity impacts of prices and other information may be ignored by concentrating on a single commodity. In some cases, it may be equally important to know the effect of a product's price and information on demand for other commodities as it may be to know the own effects (*Goddard, 1988*).

It is becoming more common in the literature to use a two stage demand system when the problem requires the definition of a manageable set of commodities (*Armington, 1969*; *Green, 1971*). A two stage demand system is built on the assumption of weak separability between the goods at the second stage of the system and all other goods consumed, for which preferences within groups can be described independently of quantities in other groups.

2.3.2 Weak Separability, Two-Stage Budgeting and Demand System Specifications

Following *Deaton and Muellbauer (1980)*, in demand analysis, when the conditional ordering on goods in the group is independent of consumption levels outside the group, the group is said to be separable. If the whole commodity vector q can be partitioned into N groups, separable preferences are represented by a utility function u composed of N sub-utility functions v:

(2.8) $u = f[\, v_1(q_1), v_2(q_2), \ldots, v_N(q_N)]$,

in which, weak separability implies that the marginal rate of substitution between two goods in one group is independent of quantities of goods consumed from outside the group. In other words, weak separability places no restrictions on substitutions between goods within a group; but between groups, substitution is limited by a factor of expenditure on one group with respect to a proportional change of all prices in the other group.

Thus, consumers' decisions are viewed as a two stage determination process. In the first stage, the consumer allocates total disposable income to broad groups of commodities such as clothes, housing, transportation, meats, beverage etc. In the second stage, the expenditure allocated to a particular group is allocated among individual consumption items within that group (e.g. milk, soft drinks and fruit juices), based on subgroup prices, expenditures, tastes and information transmitted for the particular commodities by. Weak separability is a necessary and sufficient condition for two-stage budgeting. The two-stage demand system allows a practical solution to the problem of defining a small number of goods that are reasonable to work with. It is conceptually possible to define a group of commodities in a conditional demand system that avoids specification of the complete set of demand equations theoretically obtainable from utility maximization.

The concept of weak separability was originally introduced by *Leontief (1947)* and *Sono (1961)*, and it has been widely used and developed in demand studies. In most of the empirical commodity demand studies that use demand systems, weak separability is used as a maintained assumption or untested hypothesis, and the invoked separability assumption leads to the specification of the conditional demand system. However, separability of preferences places restrictions on the preference structure of the consumer. If these restrictions are inconsistent with the true preference ordering of the consumer, the resulting specification of demand equations are invalid. Evidence is found that inappropriate aggregation of expenditure could influence subsequent estimation and test results (*Nicol, 1991*). Thus, some demand studies have undertaken the empirical test of the validity of separability assumptions in commodity demand models (*Pudney, 1981; Eales and Unnevehr, 1988; Nayga and Capps, 1994; Moschini, Moro and Green, 1994; Sellen and Goddard, 1997; Reynolds and Goddard, 1990*).

Separability types include symmetric and asymmetric separable structures (*Blackorby et al. 1978*), weak or strong separability, separability of the cost function, separability of the direct or indirect utility function, separability of an implicit representation of the direct utility function, and separability of an implicit representation of the indirect utility function. Several demand studies have considered tests of these assumptions (*Blackorby et al. 1977; Eales and Unnevehr, 1988; Pudney, 1981; Baccouche and Laisne, 1991; Nicol, 1991*).

Both parametric and non-parametric tests have been employed to test for separability of preferences. Non-parametric tests, as developed by *Varian* (*1983*), have the desirable property of not being conditional on the functional form of the utility function. These tests are nonstochastic and require preferences to be strongly separable overtime for time series data (*Swofford and Whitney, 1987*).

Parametric tests, on the other hand, have the disadvantage of being conditional on the functional form of the utility function. Most of the parametric test studies rejected the hypothesis of weak separability (*Pudney, 1981; Nayga and Capps, 1994*). *Goldman and Uzawa* (*1964*) stated the necessary and sufficient conditions for a grouping of commodities to be separable in the three separability concepts (weak separability, strong separability, and Pearce separability) first in terms of utility functions, and then characterized them in using the Slutsky terms of the corresponding demand functions. For a utility function $U(q)$ with n sub-utility functions, such that $U(q) = U_0$ $[U_1(q_1), U_2(q_2), \ldots, U_s(q_s)]$ and where q is the vector of consumption goods, the necessary and sufficient conditions for weak separability are that the intergroup Slutsky substitution terms are proportional to the corresponding income effects of the goods in question. Following *Goldman and Uzawa* (*1964*), if a utility function is weakly separable, the Slutsky substitution terms S_{ik} can be expressed as:

$$(2.9) \quad S_{ik} = \mu_{GH} \frac{\partial q_i}{\partial M} \frac{\partial q_k}{\partial M} \text{ for all } i \in G, k \in H \text{ and } G \neq H .$$

where μ is a factor which is a measure of the degree of substitutability between groups of goods, q's are quantities, G and H are separable commodity groups. This equation suggests that while weak separability places no restrictions on substitution between goods in the same group, substitution between goods in different groups occurs only through group expenditures and a factor of proportionality which characterizes the intergroup relationship. From the previous equation, we get

$$(2.10)\quad \mu_{GH} = S_{ik} \frac{\partial q_i}{\partial M} \frac{\partial q_k}{\partial M} = S_{jk} \frac{\partial q_i}{\partial M} \frac{\partial q_k}{\partial M} \text{ for all } i, j \in G,\ k \in H \text{ and } G \neq H.$$

Thus, through manipulating the last equation, a test of the weak separability hypothesis can be obtained as

$$(2.11)\quad S_{ik} \frac{\partial q_j}{\partial M} - S_{jk} \frac{\partial q_i}{\partial M} = 0 \text{ for all } i, j \in G,\ k \in H \text{ and } G \neq H.$$

Tests for weak separability have relied on Wald tests and Likelihood Ratio (LR) tests. The Wald test was used by *Eales and Unnevehr (1988)*. The advantage of the Wald test is that it is less cumbersome than the LR test since it avoids estimating both restricted and unrestricted models. But the disadvantage of the Wald test is that it is not invariant to how the nonlinear restrictions are specified (*Moschini, Moro and Green, 1994*). It is also common to use likelihood ratio tests to test weak separability. The likelihood ratio test statistic is given by

$$(2.12)\quad \psi = 2[LR_{UR} - LR_R],$$

where follows a χ^2-distribution with degree of freedom equal to the number of restrictions; LR_{UR} and LR_R are the values of the unrestricted and restricted log likelihood functions respectively.

In agricultural food demand studies, *Moschini et al. (1994)* derived a general elasticity representation of the necessary and sufficient conditions for direct weak separability of the utility function. The testing results from the U.S. food demand model provide the support for commonly used separability assumptions about food and meat demand. *Nayga and Capps (1994)*, *Sellen and Goddard (1997)* and *Reynolds and Goddard (1990)* followed the *Goldman and Uzawa (1964)* approach to test weakly separable consumer preferences for various commodities. *Nayga and Capps (1994)* conducted parametric tests of weak separability among meat products, using scanner data and the absolute price version of the Rotterdam model. Four partitions of twenty-one meat products are examined and, in each case, the hypothesis of weak separability is rejected. *Reynolds and Goddard (1990)* employed the AIDS and Rotterdam models to conduct a weak separability test for Canadian food demand. These two models gave contrasting results, which imply that one need to consider alternative specifications when conducting parametric tests of weak separability. *Sellen and Goddard (1997)* estimated the linear AIDS model for the U.S. and German coffee imports to test weak separability. Three different utility trees are tested and separability restrictions are rejected.

Besides the basic weak separability assumption, *Theil (1980)* derived the preference structure of uniform substitutes for a group of n_g goods contained in group S_g in a block independent framework. This preference structure implies that the marginal utility of a dollar spent on each good in group S_g will be affected negatively and symmetrically when an additional dollar is spent on any other good in S_g. Following *Theil (1976, 1980)*, S_g represent a group of beverages g, and $g = 1, \ldots, G$ goods. The consumer's allocation problem is first to allocate total expenditure, E, among the G goods (first stage) and next to allocate total expenditure on good g, E_g, among all $i = 1, \ldots, n_g$ detailed items of good g (second stage). Thus, E_i is the expenditure spent on detailed item *i* of good *g*. The blockwise dependent structure in the first stage enables one to estimate the demand for item *i* conditional on E_g, the total expenditure spent on good *g*.

This concept is used in import demand studies for product aggregation. *Yang and Koo* (*1994*) proposed a restricted source-differentiated almost ideal demand system (RSDAIDS) to model the demand for commodities from different origins. In a commodity market, similar products are from different sources and are competing with each other. Product aggregation, under which the demand system does not differentiate products by origins (*Hayes et al. 1990*), and block separability, which allows the model to be composed only of share equations for a good from different sources (*Alston et al. 1990*), are frequently used in import demand studies for products with different origins. Aggregation over products may bias the estimation unless all prices to be aggregated move together by the same proportion (*Hicks, 1956*). These assumptions seem strong in import demand studies. In the case of meat import demand study (beef, pork and poultry), first, Canadian consumers may perceive U.S. poultry products differently from Brazilian poultry products in product quality; second, different transaction costs cause heterogeneous movements of import prices; and third, block separability models commodity groups (e.g. poultry and beef) independently. The RSDAIDS model is a more general model that does not impose perfect substitutability. *Yang and Koo* (*1994*) estimated Japanese meat import demand using the RSDAIDS model. The RSDAIDS model has been applied in several agricultural goods import demand studies. For example, *Andayani and Tilley* (*1997*) studied the Indonesian fruit import demand; and *Dameus et al.* (*2001*) investigated Caribbean demand for U.S. and Rest-of-the-World starchy foods.

2.4 Consumer Behavior and Additional Information Variables

Consumers do not always have perfect information about the product they purchase, and their consumption decisions are influenced by information on product qualities they receive. The studies that are related to the consumer behavior and information, and the methods on how to incorporate informational variables into consumer utility function are summarized in this section.

2.4.1 Utility, Consumer Behavior and Information Variables

Classic consumer theory assumes perfect information and that consumer tastes are not changing. This implies that consumer preferences incorporate complete knowledge about the attributes of goods and services, and there is no role for information variables (e.g. advertising and food health information) in consumer utility maximization problems. However, in the short run, consumers are faced with imperfect knowledge about the quality of the product, which alters consumers' perceptions on the product. In this case, the perfect information assumption is obviously unrealistic. Information and experience becomes part of the basis of decision making. The decision process is one that consumers assimilate the appropriate data, analyzed the facts, determined the options, and assessed the constraints (*Forker and Ward, 1993*). The short run uncertainty of consumer perceptions can be reduced by acquiring more information (e.g. nutritional information and advertising). More information access may allow individuals to increase their utility from consuming goods and services (*Teisl et al. 2001*). The flow of information is a primary determinant of consumer welfare in rapidly changing market conditions (*Ippolito and Mathios, 1990*).

Various types of advertising (include generic advertising and brand advertising) are examples of product information. By disseminating information about the underlying attributes of the product, advertising programs seek to control or at least have some impact on the content and flow of information about the commodity to consumers. The impact of advertising can be observed through shifts in the demand curve, or a change in the slope of the demand curve, or changes in the shape of the demand curve (*Goddard et al. 1992*).

Empirical studies on the effectiveness of advertising have generally incorporated advertising as an explanatory variable into a demand equation in addition to prices and income. The specification of a demand function assumes the incorporation of advertising into the consumer's utility function. However, theoretical considerations and appropriate methods of including information in consumer utility function have been the subject of some debates in the literature. *Dixit and Norman (1978)* proposed the incorporation of advertising directly as an argument into the consumer's utility function. *Fisher and McGwan (1979)* suggested that including advertising as an argument in a utility function assumes that advertising directly contributes to consumer utility. They further suggest that advertising may in fact increase consumer's enjoyment associated with particular goods. *Kotowitz and Mathewson (1979)* on the other hand stated that specifying advertising in a utility function offers no understanding of its role in the consumer's decision process. *Dixit and Norman (1979)* interpreted their use of advertising in a utility function as a preference shifter, which was not an object generating utility in itself. This debate is not resolvable at this stage of time. The question about how to incorporate information sources into the consumer's utility maximization problem still remains.

2.4.2 Changing Tastes or Not

There are diverse views on how to model informational variables (e.g. various types of advertising) in the consumer utility function. Those different views can be broadly grouped into two major theoretical categories, which are changing tastes and not changing tastes.

The first approach suggests that information sources are variables in the consumer utility function either as *a parameter* or as *complements* to the good being advertised or informed (*Dixit and Norman, 1978*; *Becker and Murphy, 1993*; *Pollak and Wales, 1981*). For example, other things being constant, advertising increases the sales of a good advertised through changing consumer tastes. The second approach suggests that the intensity of informational factors signals the quality or attributes (e.g. nutrition) of the product, and information changes consumer's purchase through its informing function (*Kotowitz and Mathewson, 1979*; *Stigler and Becker, 1977*; *Milgrom and Roberts, 1986*; *Nelson, 1974*).

Under the first category, there are three sub-categories: information as a taste shifter (*Basmann, 1956*; *Dixit and Norman, 1978*; *Goddard, 1988*); information as a complement good (*Becker and Murphy, 1993*); and information as a translating and scaling variable (*Pollak and Wales, 1981*). The second approach may also include three sub-categories: household production technology change (*Stigler and Becker, 1977*); product quality signaling (*Milgrom and Roberts, 1986*; *Nelson, 1974*); and functions as quality perception modifier (*Kotowitz and Mathewson, 1979*).

Generally, consumers maximize their utility as a function of goods and services, x, subject to a budget constraint and available information set, $\varphi(.)$, on the attributes of the goods and services. The information set is assumed to depend on the stock of product attribute information, such as advertising and health information. Information is defined as: $\varphi_j = \varphi(a_1,...,a_n|x_1,...,x_n)$, where α is a vector of information for a vector of goods, x, and $\frac{\partial\varphi(\cdot)}{\partial\alpha_i} \geq 0$ suggesting that information intensity has a positive impact on a particular commodity.

(i) *Information Variables as Taste Shifters*

In the taste shifter approach, information sources are assumed to be parameters (or exogenous variables) in the consumer utility maximization problem (*Dixit and Norman, 1978*; *Basmann, 1956*). That is, the additional information influences tastes by providing better information and alters preference orderings. Additional information is not necessarily the object over which preferences are defined. The approach presumes that intensity of media coverage of food health information and advertising expenditures directly affect consumer's taste. Considering a static utility function, $u(x_1,....x_n)$, and informational variables, a, for good x can be incorporated into the consumer utility maximization problem as follows:

(2.13) $U = U(X;a) \quad s.t. \quad M = P_x^{'}X$.

where $U(.)$ is a classic static utility function, P_x is a vector of prices of x, and M is total consumer expenditure. Implicitly, this approach assumes that the prices of information are zero to the consumers. The first-order conditions for problem (2.13) are:

(2.14) $\frac{\partial U(.)}{\partial x} = \lambda p_x$, and $M = P_x' X$.

Under imperfect information, as informational factors change, the vector of parameters, $\varphi(.)$, changes resulting in changes in consumer preferences (*Chang and Green, 1989*). Based on the first-order condition, the Marshallian demand functions that depend on the information sources can be given by:

(2.15) $x = x(p, m; a)$,

and the Lagrangain Multiplier equation is:

(2.16) $\lambda = \lambda(p, m; a)$.

In equation (2.15), demand for a good depends on intensity of informational variables in addition to prices of goods and consumer income.

The effect of changes in the information sources on the quantities demanded can be obtained by differentiating the first-order conditions for maximum utility with respect to φ, as (*Basmann, 1956; Schmalensee, 1972; Barten, 1977*):

(2.17) $\frac{\partial^2 u}{\partial x_i \partial x_j} dx_j + \frac{\partial^2 u}{\partial x_i \partial \varphi_j} d\varphi_j = p_i d\lambda + \lambda dp_i$, and

$$p_i dx_j + x_j dp_i = dm,$$

$$\frac{\partial x_i}{\partial \varphi_i} = -\left(\frac{1}{\lambda}\right) \sum_k S_{ik} \left(\frac{\partial^2 U}{\partial x_k \partial \varphi_i}\right) = -\left(\frac{1}{\lambda}\right) \sum_k S_{ik} \left(\frac{\partial MU}{\partial \varphi_i}\right).$$

Using the Chain rule, the effects of intensity of information variables can be given as:

(2.18) $\frac{\partial x_i}{\partial f_i} = -\left(\frac{1}{\lambda}\right) \sum_k S_{ik} \left(\frac{\partial MU_i \partial \varphi}{\partial \varphi_i \partial f_i}\right)$, $\frac{\partial x_i}{\partial a_i} = -\left(\frac{1}{\lambda}\right) \sum_k S_{ik} \left(\frac{\partial MU_i \partial \varphi}{\partial \varphi_i \partial a_i}\right)$.

where λ is the marginal utility of money, MU is the marginal utility of the i-th good, $s_{ik} = \left(\frac{\partial x_k}{\partial p_j} + x_j \frac{\partial x_k}{\partial m} \right)$ is the Slutsky-Hicks substitution effect between goods i and k. In this relationship, if the increase in the stock of information results in the decrease in the marginal utility of good x_i, then $-\frac{1}{\lambda}\left(\frac{\partial MU_i \partial \varphi}{\partial \varphi_i \partial a_i} \right)$ is positive. Given that $-\frac{1}{\lambda}\left(\frac{\partial MU_i \partial \varphi}{\partial \varphi_i \partial a_i} \right)$ is positive, if goods x_i and x_k are substitutes (e.g. beef and chicken), then the sign of $s_{ik}\left[-\frac{1}{\lambda}\left(\frac{\partial MU_i \partial \varphi}{\partial \varphi_i \partial a_i} \right) \right]$ is positive and it adds positively to $\frac{\partial x_i}{\partial a_i}$, where $s_{ik} = \frac{\partial x^h_i}{\partial a_i}$ is Hicks substitution effect between good i and k. Again assuming that $-\frac{1}{\lambda}\left(\frac{\partial MU_i \partial \varphi}{\partial \varphi_i \partial a_i} \right)$ is positive, if goods x_i and x_k are complementary, then the sign of $s_{ik}\left[-\frac{1}{\lambda}\left(\frac{\partial MU_i \partial \varphi}{\partial \varphi_i \partial a_i} \right) \right]$ is negative and it contributes negatively to $\frac{\partial x_i}{\partial a_i}$. Under the restrictive assumption that the informational factor on good i does not affect the marginal utility of good j and the elasticity of each good's marginal utility with respect to its informational parameter is constant. An increase in the demand for a given product because of a change in informational factors must be offset by a fall in demand for other products, while the total expenditure remains constant.

This approach is widely used in the advertising effectiveness study (e.g. *Duffy and Goddard, 1995; Piggott, 2003; Brown and Lee, 1997; and Boetel and Liu, 2002*). *Duffy and Goddard* (*1995*) incorporated brand and generic advertising expenditures into an AIDS model for pork using the demand-shifter approach. *Brown and Lee* (*1997*) incorporated generic and brand advertising effects in the Rotterdam demand model using equation (2.18) to examine the beverage consumption.

(ii) *Information Variables as Substitutes and Complements*

The second procedure for incorporating information sources into consumer theory is to treat informational variables as substitutes or complements to the commodities of interest in the utility functions (*Becker and Murphy, 1993*). As opposed to the taste-shifter approach, information is an argument of the utility function and is assumed to generate utility to the consumer. For example, *Becker and Murphy (1993)* treated advertising in the same way as those complement goods. Considering a utility function that depends on good x, and a can be incorporated into consumer optimization problem as follows:

(2.19) $U = U(x,a) \quad s.t. \quad M = P_x^{'} X + P_a^{'} a$,

where P_a are vectors of prices of informational variables. Based on equation (2.19), the Marshallian demand systems that depend on the informational variables, prices of goods and income can be given as:

(2.20) $x = x(p_x, m, p_a)$ and $\lambda = \lambda(p, m, a)$.

The general demand function for informational variables can be given as:

(2.21) $a = a(p_x, m, p_a)$.

For the i-th informational variable, the effect of the price on the level of information intensity (i.e. the Slutsky equation) can be given as:

(2.22) $$\frac{\partial a_i(.)}{\partial p_i} = \frac{\partial h_i(.)}{\partial p_i} - \frac{\partial a(.)}{\partial m} a_i^{*}.$$

If the prices of information sources are assumed to be zero, the above results reduce to the taste-shifter results. *Lee and Brown (1992)* have estimated the shadow prices of advertising using a Translog cost function for orange juice demand in the U.S.

(iii) *Translating and Scaling Procedure*

Informational variables can be incorporated into consumer demand functions in several other ways consistent with consumer theory. For the demand function to be theoretically plausible with underlying consumer behavior, the procedures considered include demographic translating, demographic scaling, the Gorman procedure (a specification which includes both translating and scaling), reverse Gorman procedure, Prais-Houthakker procedure and economies of scale in consumption (*Pollak and Wales, 1981*).

The demographic translating approach replaces the original consumer utility maximization problem by:

$$(2.23)\quad U = \overline{U}(x_1 - \varphi_1, x_2 - \varphi_2, \ldots, x_n - \varphi_n) \qquad s.t. \quad M = P'X\ ,$$

where φ's are translating parameters, which depend on the level of information intensity, $\varphi_i = \overline{\varphi}^i(e,a)$. Information sources are assumed to affect the parameters of the demand function. The coefficients of a static demand model are functions of information variables (*Alston et al. 2000*). Translating introduces a fixed cost as it requires the consumer to consume a minimum amount of the good in question. The translating approach is appropriate if a positive informational factor serves to increase the subsistence consumption level by convincing consumers that there is a certain minimum amount of the good that should be consumed for good health, or a negative information source may lead to a decrease in the subsistence consumption level.

Given the utility maximization problem in equation (2.23), the translated demand system will have the following general form:

(2.24) $x_i = \varphi_i + x^i\left(p, m - \sum p_k . \varphi_K\right)$.

Assuming the absence of cross-product effects, the own-information effect can be obtained by differentiating equation (2.24) with respect to a, and using the Chain rule as:

(2.25) $\dfrac{\partial x_i}{\partial a_i} = \left(\dfrac{\partial \psi_i}{\partial a_i} - \dfrac{\partial \psi_i}{\partial a_i} p \dfrac{\partial x_i}{\partial m}\right)$.

Equation (2.25) suggests that information intensity has a positive own-effect on demand if the term $p\dfrac{\partial x_i}{\partial m}$ is less than one. The first term on the right hand side of the equation for the infromation effects is termed as a direct effect which is positive if information creates "need", and the second term is an indirect effect which depends on the income effect (*Brown and Lee, 1992*). *Boetel and Liu* (*2002*) used the translating approach to incorporate advertising expenditures into the Rotterdam model for the U.S. meat demand. Others who used the translating approach include *Comeau et al.* (*1997*), *Duffy* (*1995*), and *Kim and Chern* (*1999*).

The scaling approach scales prices and quantities by information intensity. The scaling approach has the capacity to shift individual indifference curves through the impact on effective prices. This approach is reasonable when additional information such as health information has an impact on perceptions of the quality of a product. Information sources change the effective quantities and prices of goods. The consumer utility maximization problem for the scaling approach can be given as:

$$(2.26)\quad U(x)=\overline{U}(x_1/\psi_1,\ldots,x_n/\psi_n) \quad s.t. \quad P'X=M,$$

where ψ's are scaling parameters which depend on the level of informational variables as $\psi_i=\overline{\psi}^i(a)$. The corresponding scaled demand system is:

$$(2.27)\quad x_i=\psi_i\overline{x}^i(p_1\psi_1,\ldots,p_I\psi_I,m).$$

Assuming that there are no cross-product effects of informational variables, the own-information effect can be obtained by differentiating equation (2.27) with respect to *a* (*Brown and Lee, 1992*):

$$(2.28)\quad \left(\frac{\partial x_i}{\partial a_i}\right)\left(\frac{a_i}{x_i}\right)=-\left(\frac{\partial \psi_i}{\partial a_i}\right)\left(\frac{a_i}{\psi_i}\right)\left(1+\frac{p_i\partial x_i^*}{x_i^*\partial p_i}\right).$$

where $x_i^* = x_i\psi$. Equation (2.28) suggests that the information intensity has a positive own-effect on demand if the demand is price elastic. This indicates that the only way that advertising elasticities will be positive is if the price elasticity of demand is greater than one in absolute value. Hence, the use of scaling to introduce curve shifters appears to be limiting. Based on this argument, *Piggott (1997)* suggested using translating rather than scaling when shift parameters are used.

Chang and Green (1989) applied the scaling approach to a Linear Expenditure System (LES) to investigate the effects of advertising on food demand elasticities. Scaling is similar to the *Lancaster (1975)* approach because the scaling functions can be thought of as the variables representing a good's characteristics, and the scaling function scales the physical quantity of the good in the utility function (*Lee and Brown, 1992*).

Pollak and Wales (1981) also proposed the Gorman specification involving both translating and scaling as an alternative model. The Gorman specification incorporates both the translating and scaling approaches simultaneously in the utility function. The consumer utility maximization problem for the Gorman specification can be given as:

(2.29) $U(x)=\bar{U}\left((x_1-\varphi_1)/\psi_1,...,(x_n-\varphi_n)/\psi_n\right) \quad s.t. \quad P'X=M$,

with the corresponding demand system:

(2.30) $x_i=\varphi_i+\psi_i\bar{x}^i(p_1\psi_1,...,p_n\psi_n,m-\sum p_k.\varphi_K)$.

Although they have not used it, *Brown and Lee* (*1992*) suggest a combination of scaling and translating as the effects of advertising in the combined model are dependent on both income and price elasticities.

(iv) *Household Production Theory*

A further approach is based on household production theory (*Stigler and Becker, 1977*; *Pollak and Wachter, 1975*; *Muellbauer, 1974*; *Deaton and Muellbauer, 1980*), in which informational variables are considered as an input into a commodity produced and consumed by the household. Information about a given good can be positive or negative.

Suppose that there are n market goods, $X = (x_1, x_2,..., x_n)$ that are inputs into the production of m commodities denoted by $Z = (z_1, z_2,..., z_m)$. A household seeks to maximize: $U=\bar{U}(z_1,...,z_n)$, where $Z_i=z_i(x,i,e,r)$, z_i's are commodity objects of choices entering the utility function, $z_i(.)$ is the production function for the i-th commodity, x_{ij} is the quantity of the j-th market goods or services used in the production of the i-th commodity, e is human capital of the household, i is the stock of information, and r represents all other inputs. The household's preferences are represented by a utility function $U(Z)$ defined over the commodity space. Product information contributes towards a stock of information employed in the production of commodities. The consumer utility maximization problem can be given by:

$$(2.31)\quad \begin{array}{l} \max U(Z_1,\ldots,Z_n) \quad Z>0 \\ s.t. \quad Z_i = z_i(x_{1i},\ldots,x_{ni},i_{1i},\ldots,i_{ni},e,r) \quad \text{and} \quad M = P'X \end{array}$$

where $i_j = i(a_1,\ldots,a_n)$. According to *Stigler and Becker* (1977), changes in information intensity, such as advertising expenditures, are inputs to the production of non-market commodities that the household produces. A change in the information intensity would cause a change in the shadow price of the non-market commodities produced by the household. According to *Muellbauer* (*1974*), the utility maximization problem can be thought of in two stages, where the first stage involves minimization of costs of producing any given bundles of Z, and the second stage involves the maximization of the household utility defined over commodities subject to the dual cost function. From the two-stage optimization problem, we have the following reduced form of the demand function for commodities: $z^*(p,a,m,e)$.

By considering the household as a firm, *Lee and Brown* (*1992*) used the theory of household production to incorporate information variables in a Translog demand function. *Kinnucan et al.* (*1997*) also used the household production theory to include food health information and advertising expenditures in the demand systems. *Cox* (*1992*) used a household production framework to theoretically derive the basis for demographic translating and scaling.

A closely related approach is proposed by *Nelson* (*1974*), in which equilibrium advertising intensity is assumed to signal product quality in markets. "Information is generated by advertising because of consumer power in product market" (*Nelson, 1974*;

Schmalensee, 1972). Studies (e.g. *Schmalensee, 1972; Wilkinson et al. 1982*) stated that the relationship between advertising and the product quality is an empirical issue. If advertising is very effective, intensity of advertising expenditures and product quality are inversely related (*Comanor and Wilson*, 1979). According to *Nelson (1974)*, advertising makes little sense for search goods[2] because information concerning quality is already available and advertising is not effective. On the other hand, *Schmalensee (1972)* demonstrated that if advertising is less effective, advertising levels and product quality are positively related as claimed by *Nelson (1974)* for experience goods[3].

(v) *Information Affects Consumers through Changes in Quality Perceptions*

Kotowitz and Mathewson (1979) developed the dynamic consumer utility maximization problem which accommodates quality characteristics differentiated by the consumer's ability to evaluate quality in use. In their dynamic maximization model, advertising affects consumers through changes in quality perceptions. One of Kotowitz and Mathewson's dynamic model predictions is that if improved quality perception causes the price elasticity of demand to fall at the monopoly price, advertising will tend to raise the price with subsequent loss to consumers.

(vi) *Interaction Effects of Advertising Expenditures and Other Variables*

More theoretical evidence exists about the effects of advertising expenditures than evidence exists regarding the interaction effects of price and advertising, price and

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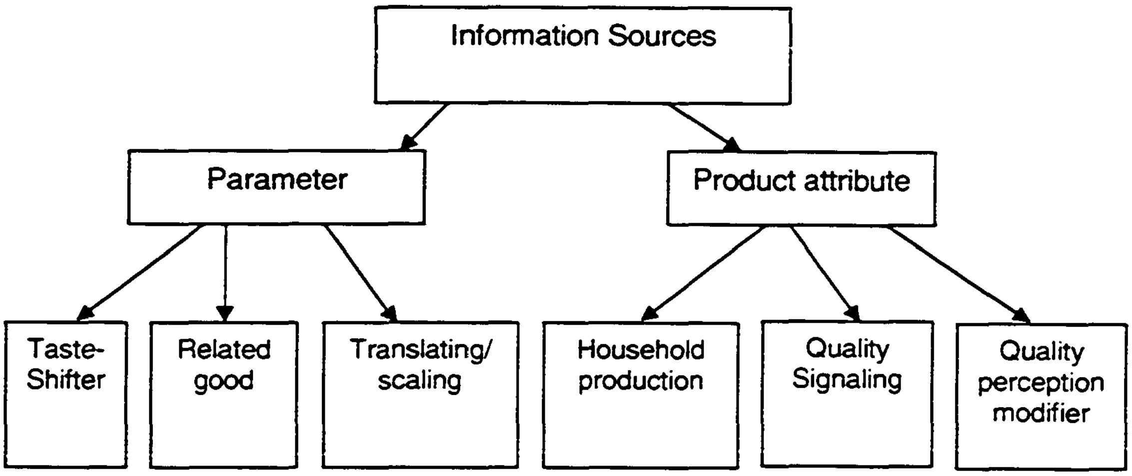
[2] Search good: Goods possess qualities that can be determined by inspection prior to the purchase (Nelson, 1974).
[3] Experience good: Qualities of the good can be evaluated only after the purchase or through consuming it (Nelson, 1974).

income, and advertising and income. *Monroe (1973)* and *Moriarty (1983)* evaluated the relationships between prices and other variables. The marketing literature suggests that advertising may not only be an independent demand shifter but a factor that directly interacts with prices (*Eskin and Baron, 1977; Moriarty, 1983; Wilkinson et al. 1982; Prasad and Ring, 1976*). For example, *Moriarty (1983)* modeled the interaction effect of the price with advertising for a product using a multiplicative term. *Prasad and Ring (1976)* also incorporated the interaction between prices and media advertising in brand market share model using multiplicative terms.

Figure 2.1 Approaches to incorporating information sources into consumer utility maximization problem



2.5 Incorporation of Socioeconomic and Demographic Variables into Demand Function

Various socioeconomic and demographic variables have been incorporated into demand studies to test their potential effects on consumer demand (e.g. *Yen and Lin, 2002*). The most widely used socioeconomic and demographic variables include major categories such as:

1) Geographic location: province, urban or rural area;

2) Characteristics of reference person: age, sex, marital status, and educational background;
3) Employment status or labour force participation;
4) Immigration status and ethnic origin;
5) Household composition and household size;
6) Total household income.

The underlying hypothesis is that non-market socioeconomic factors have influences on consumption decisions. Most of the socioeconomic and demographic variables have readily defined values or choices in the household survey data and can be easily used in demand analysis. The challenge is to decide how to incorporate demographics into the consumer utility function.

The literature to be reviewed can be categorized into three groups. First, the household production theory (*Becker, 1965*; *Lancaster, 1966*) has been used as a platform to incorporate socioeconomic characteristics into the demand function. Second, *Pollak and Wales* (*1981*) proposed five procedures to investigate the demographic effects on demand. Third, the demographic variables can be either treated as exogenous or endogenous variables in the consumer demand function.

Household Production Theory

A household is seen as both a production and consumption unit considering the opportunity cost of time spent on non-wage-earning work. The household maximizes the indirect utility function by household production of non-market goods (e.g. time) and direct consumption of market goods (also see Section 2.4.2 (iv)). In *Blundell and Walker*

(*1984*), they proposed a method of incorporating demographic variables into demand analysis which is derived explicitly from a household production framework. The resulting specification allows demographic composition to have an additive fixed cost effect on expenditures and an effect on marginal budget shares. The fixed cost effect can allow for substitution between the inputs of market goods in household production. The paper estimated a pooled cross-section/time-series UK budget data. The estimated parameters suggest that the substitution possibilities are important and that young children have a large impact on marginal budget shares. They argue that the fixed cost term is the appropriate measure of the cost of a child for welfare purposes. Many of the agriculture food demand studies applied the household production framework to incorporate demographic variables (e.g. *Nayga, 1996*).

Pollak and Wales (1981) Procedure

Explicitly, *Pollak and Wales* (*1981*) described, estimated and compared five general procedures for incorporating demographic variables into complete demand systems without assuming a particular functional form. The five procedures are: demographic translating; demographic scaling; the "Gorman procedure", a specification which includes both translating and scaling as special cases; the "reverse Gorman procedure"; and a specification called the "modified Prais-Houthakker procedure". Those procedures assume that the original demand systems are "theoretically plausible", that is, they can be derived from "well-behaved" preferences. Each procedure replaces this original class of demand systems by a related class involving additional parameters and postulates that only these additional parameters depend on the demographic variables.

Out of the five procedures, demographic translating and demographic scaling are the most widely used in the food demand literature (e.g. *Heien and Durham, 1991*; *Perali and Chavas, 2000*). If a demand system is specified as a function of prices and total expenditure, demographic translating replaces the original demand equation with a function of household characteristics. Translating can be interpreted as allowing "necessary" or "subsistence" parameters of a demand system to depend on the demographic variables. For demographic scaling procedure, the demand equation and prices are multiplied by a function of demographic variables. In their paper, *Pollak and Wales* (*1981*) used the five procedures to incorporate a single demographic variable, the number of children in the household, into a generalized CES demand system for British household budget data estimation. Their results indicated that the number of children in the household does affect consumption patterns. All the four procedures, except demographic translating, imply similar responses to changes in prices, total expenditure, and the number of children.

Exogenous or Endogenous Variable

Most of the literature treats demographic variables as exogenous primarily in two ways (*Pollak and Wales, 1978, 1981*; *Blundell and Walker, 1984*): in most cases, demographic variables are modeled as explanatory variables (*Dong et al. 1998*; *Yen and Huang, 1996, 2002*; *Cox and Wohlgenant, 1986*; *Byrne et al. 1996*); the demographic variables can also enter the demand system by specifying the intercept term as a function of demographic variables (*Heien and Pompelli, 1988*; *Yen and Chern, 1992*).

In contrast, the neoclassical fertility literature (*Schultz, 1973*) treats the number and ages of children as endogenous non-market goods within a lifecycle optimizing framework. Some socioeconomic variables are treated as endogenous in agricultural food demand analysis as well (*Yen, 1993*; *Gould et al. 2002*; *Gould and Yen, 2002*). *Gould et al.* (*2002*) used the adult equivalents scale, which was obtained from assigning different weights to household members according to their age and gender (*Deaton and Muellbauer, 1986*), as an endogenous variable to model the household demand that each household member has different impacts on food purchases/expenditures. In studies that discuss the influence of a women's employment status on food away from home or on nutrient intake, the variables for a woman's participation in the labour force is considered endogenous (*Yen, 1993*). Instrumental variables are always used to model the choice of women's work status (e.g. length of hours, full-time or part-time).

2.6 Health Information

In conventional consumer theory, it is assumed that consumers have complete knowledge about goods and their attributes. However, this assumption does not exist when health information changes consumers' attitudes toward a good, and in turn changes their demand for the good. Over the past decades, researchers have been paying much attention to how health information affects consumers' choices. Health information indices are developed as proxy variables to test the hypothesis that changing health information has influenced consumer choices. The research has been done for meat, eggs and dairy products (*Wilson and Marsh, 2000*). Studies with regard to health information indices and how to construct the health information indicators will be reviewed in this section.

2.6.1 Health Information Indices

In the health information literature, there are two major ways to measure the impacts of health information on demand.

One way is to include the demand for health in utility theory (*Lancaster, 1971*) by linking consumers' health knowledge directly to characteristics of goods. In this case, consumer surveys are used to decide the knowledge that people have about the implications of diet on health (*Chung and Kaiser, 2000*). However, *Chern* (*2000*) argued that the surveys are not specific enough to measure the impact of a specific quality of a food on demand. Analysis that incorporates a measure of the information flow was recommended instead.

The other way is to measure the impact of changing information on consumer behavior by constructing the information indices or information proxy variables. Consumers receive information from all kinds of sources, such as the media, health practitioners, other people, and their own research. Demographic and health status also have influence on the extent to which consumers will use the information they receive. It is necessary to find indicators of the flow of information instead of the actual information from all kinds of sources.

2.6.2 Consumers' Responses to Health Information

The hypothesis that consumers change behavior when they receive health information has been tested in food demand studies, including meat demand, egg demand and dairy product demand.

For meat and egg demand studies, results suggested that changes in cholesterol information had a significant impact on quantities demanded. For example, *Brown and Schrader (1990)* found that from 1963 to 1987, shell egg consumption in the U.S. reduced by from 16% to 25%, and that the negative effect of health information on demand reduced the price and income elasticities. *Kinnucan et al. (1997)* found that the health information index elasticities are larger than the own price elasticities for the poultry demand. Health information appears to be a powerful source of changing consumer behavior in meat demand (*Burton et al. 1996; Burton and Young, 1996*). However, none of them attempted to measure health knowledge directly. Health information indicators or proxy variables are constructed in these papers.

2.6.3 Construction of Health Information Indicators

The first quantitative work on a health information indicator is done by *Brown and Schrader* in 1990. They studied the linkage between the negative health information of diet cholesterol and the egg shell demand. *Brown and Schrader (1990)* index has been developed in other studies to measure health information, and has been used in demand studies.

All of the studies reviewed use a count of articles for a proxy of information that reaches consumers. Medical journals and mass media reports are two major sources of the health information. The index used by Brown and Schrader, as well as *Kinnucan et al.* (*1997*), and *Wilson and Marsh* (*2000*), is constructed based on the count of articles found with a Medline search, which covered articles in over 3,200 journals at that time. Over 8,000 articles were found by using a search term of cholesterol and restricting the search in English language articles. The search was further restricted to articles that were relevant only to the linkage between diet cholesterol, serum cholesterol and heart disease or arteriosclerosis. The English articles from British, Canada and Scandinavia were also excluded from the counting. For the period 1966-1987, 890 articles suggesting a link between diet cholesterol an arterial disease, and 39 articles attacking the link were identified.

Brown and Schrader (*1990*) index was used in *Capps and Schmitz* (*1991*) and *Yen and Chern* (*1992*). *Kinnucan et al.* (*1997*) updated the Brown and Schrader indexs and modified the index by weighting it with the proportion of negative articles. *Wilson and Marsh* (*2000*) updated and used the basic Brown and Schrader index with Kinnucan et al. weighting. *Chern* (*2000*) created two series. One is based on Mediline journal articles search which updated *Chern and Zuo* (*1997*) index to 1997. The other index used by *Chern* (*2000*) is based on mass media messages which are proxied by articles in the Washington Post.

Two of the reviewed papers included a health information index based on newspaper articles. These are *Chern* (*2000*) and *Nivens and Schroeder* (*2000*). The Chern index of Washington Post articles was constructed from 1978 to 1997, using the Lexis/Nexis search engine. The key words they used in the search included: "fat and cholesterol and heart disease or arteriosclerosis" for the period of 1965-1997 in all

English language journals in the world. *Nivens and Schroeder* (*2000*) constructed two health indices for BSE based on newspaper articles identified through a Lexis/Nexis search. Positive counts included counts of articles that reported no link between BSE and CJD, or that BSE was declining. All other articles were considered negative.

2.6.4 Positive and Negative Information

"Positive" information typically refers to information that encourages consumption of the good. For instance, positive information is information that suggests calcium is good for health. Therefore milk, where calcium is derived from, is good for health. In contrast, "negative" health information discourages demand for related goods. For example, negative information suggests a link between calcium and cancer, and may decrease consumer demand for milk.

Brown and Schrader constructed a health information variable that in each period is equal to the number of negative articles less the number of positive articles. *Kinnucan et al.* (*1997*) used the Brown and Schrader index, but weighted it by the proportion of all articles in a period that are negative. *Chern* (*2000*) used a sum of all articles without noting whether the articles promote consumption or discourage it.

Nivens and Schroeder (*2000*) created their own indices based on newspaper articles about BSE. They classified the articles as either negative or positive based on titles. The two indexes entered the analysis separately. They counted an article as positive (encouraging beef consumption) if it stated that BSE was not related to CJD, that BSE is declining, or that there is a cure for either disease. Any other articles are counted as negative.

For all the studies reviewed here for cholesterol or BSE, no attempt was made to identify the articles that are neutral in position.

2.6.5 Weights

Weights were used by *Kinnucan et al.* (*1997*) in constructing the health information indicator. They used the unweighted *Brown and Schrader* (*1990*) index, and weighted it by the proportion of articles that are negative in each year.

Nivens and Schroeder (*2000*) weighted each newspaper article about BSE published in the year by the ratio of the publishing newspaper's circulation to the circulation of the largest newspapers. The reason for this was to make sure that an article published in a small regional newspaper with a small circulation is not considered to have as large an impact on consumers as a newspaper with a much larger circulation.

2.7 Choices of Demand Systems

Commonly used demand systems include the Rotterdam model (*Theil, 1965*), the AIDS model (*Deaton and Muellbauer, 1980*), the Translog model (*Christensen et al. 1975*), and the *Lewbel* model (*1989*). These demand models are flexible and consistent with consumer theory.

2.7.1 Almost Ideal Demand System (AIDS)

The Almost Ideal Demand System (AIDS) of *Deaton and Muellbauer* (*1980*) has been one of the most widely used flexible demand specifications. It was derived, by the use of duality concepts, from the flexible consumer expenditure function known as the price-independent generalized logarithmic (PIGLOG) form.

The basic budget share equations of an AIDS model are given by:

(2.38) $W_i = a_i + \Sigma\gamma_{ij} \ln P_j + b_i \ln(X/P)$.

The budget share equations are derived by applying Shephard's Lemma and making use of dual identities to the expenditure function. The expenditure function as defined by *Deaton and Muellbauer (1980)* is the minimum expenditure necessary to attain a given level of consumer utility at given current prices. The expenditure function is specified as:

(2.39) $\ln [c(u,p)] = (1-u) \ln[a(p)] + u \ln[b(p)]$,

where $\ln [a(p)] = a_0 + \sum_i a_i \ln(P_i) + \frac{1}{2}\sum_i \sum_j \gamma_{ij} \ln Pi \ln Pj$,

$\ln [b(p)] = \ln [a(p)] + b_0 \prod_i P_i^{b_i}$.

and $W_i = \dfrac{P_i X_i}{\sum_i P_i X_i} = \dfrac{\partial \ln c(u,P)}{\partial \ln p_i}$,

where w_i = expenditure share of commodity i,

P_j = price of individual goods,

X = total expenditures,

$\ln(p_i)$ = log of price of commodity j,

$\ln(X)$ = log of commodity expenditure,

and $\ln(P)$ = price index expressed as:

$$\ln(P) = a_0 + \Sigma_j a_j \ln(P_j) + \frac{1}{2}\sum_i \sum_j \gamma_{ij} \ln p_i \ln p_j .$$

The restrictions on the parameters of the share functions include adding-up, $\sum_i \alpha_i = 1$, $\sum_j \beta_j = 0$, $\sum_j \gamma_{ij} = 0$; homogeneity, $\sum_i \gamma_{ij} = 0$; and summetry, $\gamma_{ij} = \gamma_{ji}$.

The standard AIDS specification is non-linear in parameters, and is approximated by its linearised version, know as the linear approximation (LA) version of the AIDS demand system. In the LA/AIDS model, the non-linear AIDS price index is replaced with Stone's linear approximate price index, where the latter is defined as:

$$(3.40)\quad \ln(P) \approx \ln(P^*) = \sum_j W_j \ln(p_j).$$

To incorporate advertising variables and other information variables into the utility function with the AIDS model, we have three different models to work on. First, advertising and other information variables as independent shifters, the budget share equations are given as:

$$(2.41)\quad W_i = \alpha_i + \sum_j \gamma_{ij} \ln(p_i) + b_i \ln (X/P) + \sum_j f_{ij} \ln(A_j) + \sum_j g_{ij} \ln(S_j)$$

where, A_j = advertising publicity or expenditures on commodity j;

S_j = other information variables.

The second approach was illustrated by *Green (1985)*. He suggested that, in order to include the effects of particular non-price and non-income exogenous variables as independent demand shifters, the a_i's in the standard AIDS model should be modified as:

$$(2.42)\quad a_i = a_i^* + \sigma_i \mathrm{T} + \sum_{k=1}^{4} \lambda_{ik} Q_k + \sum_j \delta_{ij} A_j + \tau_i C$$

where, T = time,

Q_k = quarterly dummies, representing seasonality;

A_j = advertising publicity or expenditures on of commodity j;

C = cholesterol index,

λ_{ik}, σ_{ij}, and τ_i are coefficients to be estimated.

Another approach to incorporate the effects of advertising and other information variables is through scaling effects on quantities in the utility function. This approach was used by *Duffy (1987)* and *Green et al. (1991)* to assess the impact of advertising on consumer demand. The basic feature of this approach is that the quantities in the utility function are multiplied or divided by parameters reflecting exogenous factors. In this case, the effect is modeled by multiplication of the inverse of the advertising variable, which is expected to offset the tendency for a decrease in consumption caused by an increase in the price of a good. *Brown and Lee (1992)* indicated that "scaling" the price variable in this case could be a source of restriction on the specification. By incorporating the advertising impact through scaling, the cost function for the AIDS model can be written as:

$$(2.43)\quad \ln [c(u, \frac{p}{a})] = a_0 + \sum_i a_i [\ln(P_i) - \ln(A_i)]$$

$$+\frac{1}{2}\sum_i \sum_j \gamma_{ij} [\ln(P_i) - \ln(A_i)] [\ln(P_j) - \ln(A_j)] + u\, b_0 \prod_i p_i^{\beta_i}$$

By applying Shephard's Lemma, inverting, and substituting for u, the budget share equation is modified as:

$$(2.44)\quad W_i = \alpha_i + \sum_j \gamma_{ij} [\ln(p_j) - \ln(A_j)] + b_i \ln (X/P) + e_i,\ i,j = 1,2, \ldots n$$

where, e_i is an error term and the nonlinear price index lnP is given by:

$$(2.45)\quad \ln(P) = a_0 + \sum_i a_i [\ln(P_i) - \ln(A_i)]$$

$$+\frac{1}{2}\sum_i \sum_j \gamma_{ij} [\ln(P_i) - \ln(A_i)]*[\ln(P_j) - \ln(A_j)].$$

The AIDS model has been developed into various more globally efficient specifications in the past 20 years. *Cooper and McLaren (1992)* developed a modified AIDS (MAIDS) model to correct the violation of negative semi-definiteness in the estimated Slutsky matrix in the AIDS model. They compared the empirical results between AIDS and MAIDS, and found that the MAIDS is indeed more regular than the AIDS. *Banks et al. (1997)* developed the Quadratic Almost Ideal Demand System (QUAIDS). They found that, with a minimum number of parameters and departures from linearity, the QUAIDS model produced a data-coherent and plausible description of consumer behavior, from which the welfare measures associated with price and tax could be calculated.

Yang and Koo (1994) proposed a restricted, source-differentiated AIDS model to analyze the import demand for agricultural products. The RSAIDS model can be written as:

$$(2.46)\quad w_{ih} = \alpha_{ih} + \sum_{k} \gamma_{ihik} \ln(p_{ik}) + \sum \gamma_{ihj} \ln(p_j) + \beta_{ih} \ln\left(\frac{E}{P}\right),$$

where $\ln(p_j) = \sum w_{jk} \ln(p_{jk})$, w_{ih} is the budget share of good i imported from source h, α_{ih} is the intercept term, γ_{ihik} is the price coefficient of good i from the different sources k (with k icluding h) in the equation of good i from origin h, p_{ik} is the price of good i imported from sources k (with k including h), γ_{ihj} is a cross-price coefficient of the non-source differentiated or aggregated good j in the equation of good i from origin h, p_j is the price of the non-source differentiated or aggregate good j (for j not equal to i), β_{ih} is the real expenditure coefficient, E is group expenditures, and P is the Stone price index.

The demand restrictions of adding-up, homogeneity and symmetry for the RSDAIDS are given as following:

(2.47) $\sum_i \sum_h \alpha_{ih} = 1;\ \sum_h \gamma_{ihik} = 0;\ \sum_i \sum_h \gamma_{ihj} = 0;\ \sum_i \sum_h \beta_{ih} = 0;$ (Adding-up)

$\sum_k \gamma_{ihik} + \sum_{j \neq i} \gamma_{ihj} = 0;$ (Homogeneity)

$\gamma_{ihik} = \gamma_{ikih}$ (Symmetry)

2.7.2 Translog Demand System

Christensen et al. (*1975*) attributed the Translog demand system, which was characterized as a second-order Taylor series approximation to any arbitrary utility function.

The standard Translog indirect utility function, in prices and total expenditure, is given as:

(2.48) $\ln V = \alpha_0 + \sum_{i=1}^{n} \alpha_i \ln P_i^* + \frac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} \beta_{ij} \ln P_i^* \ln P_j^* \quad i, j = 1, 2, \ldots, n,$

where $P_i^* = P_i / TEXP$, and $\beta_{ij} = \beta_{ji}$.

Using the logarithmic form of Roy's identity, expenditure shares for the i^{th} commodity are:

(2.49) $\frac{P_i X_i}{TEXP} = -\frac{\partial \ln V}{\partial \ln P_i} / \frac{\partial \ln V}{\partial \ln TEXP} \qquad i = 1, 2, \ldots, n.$

For the Translog indirect utility function, the expenditure shares are expressed as:

(2.50) $\frac{P_i X_i}{TEXP} = W_i = \frac{\alpha_i + \sum_j \beta_{ij} \ln P_j^*}{\sum_i \alpha_i + \sum_i \sum_i \beta_{ij} \ln P_j^*} \qquad i, j = 1, 2, \ldots, n.$

for the condition of adding up, $\sum W_i = 1$.

The basic Translog model has been modified to relax the assumption of perfect information and to include the effects from various information variables, such as advertising and health information. Assuming that advertising is a preference shifter *(Dixit and Norman, 1978)*, *Goddard et al. (1992)*, *Goddard and Tielu (1988)* and *Goddard and Amuah (1989)* incorporated advertising expenditures in the Translog model. The indirect utility function is given by:

$$(2.51)\quad \ln V = \alpha_0 + \sum_{i=1}^{n} \alpha_i \ln P_i^* + \sum_{i=1}^{n} g_i \ln A_i + \frac{1}{2}\sum_i \sum_j \beta_{ij} \ln P_i^* \ln P_j^*$$

$$+ \frac{1}{2}\sum_i \sum_j m_{ij} \ln A_i \ \ln A_j \ + \sum_i \sum_j c_{ij} \ln P_i^* \ln A_j \qquad i, j = 1,2, \ldots, n$$

Expenditure shares are:

$$(2.52)\quad W_i = \frac{\alpha_i + \sum_j \beta_{ij} \ln P_j^* + \sum_j C_{ij} \ln A_j}{\sum_i \alpha_i + \sum_i \sum_i \beta_{ij} \ln P_j^* + \sum_i \sum_j C_{ij} \ln A_j} \qquad i, j = 1,2, \ldots, n.$$

The normalization of the parameters $\sum_i \alpha_i = -1$ is used since the expenditure share equation is homogenous of degree zero in prices and total expenditure. Imposing symmetry, adding up, and maintaining a hypothesis of homotheticity requires the following respective constraints on system: $\beta_{ij} = \beta_{ji}$, $\sum_j \beta_{ij} = 0$, $\sum_i \alpha_i = -1$ (i, j = 1,2, ..., n). The homotheticity restriction constrains the expenditure elasticities for each commodity type to be equal to one in the second stage.

Goddard and Tielu (*1988*) also incorporated the effects of habit formation in the expenditure share system. Assuming that α_i depends on the consumption of the preceding period linearly, the expenditure share system can be modified by the term:

(2.53) $\alpha_i = a_i + r_i x_{it-1}$,

and the resulting dynamic stochastic expenditure share equation is:

$$(2.54)\quad w_{it} = \frac{a_i + r_i x_{it-1} + \sum_j \beta_{ij} \ln\left(\frac{p_{jt}}{E_t}\right) + \sum_j D_{ij} \ln(A_{it})}{-1 + \sum_i r_i x_{it-1} + \sum_i \sum_j \beta_{ij} \ln\left(\frac{p_{jt}}{E_t}\right) + \sum_i \sum_j D_{ij} \ln A_{jt}} \qquad i, j = 1,2, \ldots, n.$$

2.7.3 Nesting the AIDS and Translog Demand Systems – *Lewbel* (*1989*) Model

Lewbel (*1989*) developed a demand model that has nested within it both the AIDS and Translog models, and that is consistent with utility maximization. The model is derived from the indirect utility function, using Roy's identity, to the expenditure share equations. For a commodity bundle with n goods, prices $p = (p_1, \ldots, p_n)'$, and total expenditure x, the indirect utility function $V(p,x)$ can be specified as:

$$(2.55)\quad \log\,[V(p,x)] = \sum_{i=1}^{n} b_i \log p_i + \log$$

$$\left[d + \sum_{i=1}^{n} \alpha_i \log p_i + 0.5 \sum_{i=1}^{n} \sum_{j=1}^{n} c_{ij} \log p_i \log p_j - \left(\sum_{i=1}^{n} \alpha_i + \sum_{i=1}^{n} \sum_{j=1}^{n} c_{ij} \log p_j \right) \log x \right],$$

where $\sum_{i=1}^{n} \alpha_i = 1$, $\sum_{i=1}^{n} b_i = 0$, $\sum_{i=1}^{n} \sum_{j=1}^{n} c_{ij} = 0$, and $c_{ij} = c_{ji}$ for all i, j. By Roy's identity, Lewbel's flexible demand system in expenditure share form can be derived as:

$$(2.56)\quad w_i = \{\ \alpha_i + \sum_{j=1}^{n} c_{ij} \log p_j + b_j \left(d + \sum_{j=1}^{n} \alpha_j \log p_j + 0.5 \sum \sum c_{jk} \log p_j \log p_k \right)$$

$$-\left[\sum_{j=1}^{n} c_{ij} + b_i\left(1+\sum_{i=1}^{n}\sum_{k=1}^{n} c_{jk}\log p_k\right)\right]\log x \} \bigg/ \left(1+\sum_{j=1}^{n}\sum_{k=1}^{n} c_{jk}\log p_k\right), \; i = 1, \ldots, n.$$

Restrictions imply adding-up, homogeneity, and symmetry of the demand system. Interesting properties of this demand system are that restrictions $b_i = 0$ for all i reduce the system to the Translog model, whereas restrictions $\sum_{j=1}^{n} c_{ij} = 0$ for all i lead to the AIDS model. Lewbel estimated the nested model, the AIDS model, and the Translog model, using the U.S. Bureau of Labor Statistics Consumer Expenditure Survey for the year 1980-1983. The results showed that the AIDS and Translog models are about equal in terms of both explanatory power and estimated elasiticities. The flexible demand system is concluded to be superior statistically, and its elasticity estimates are close to those of the other models.

Yen and Chern (*1992*) applied the Lewbel model in estimating U.S. demand for fats and oils from 1950 to 1986. Results suggest that the Lewbel model outperforms the Translog and AIDS models. However, the application of the Lewbel model has not been widely used in food demand studies.

Bollino and Violi (*1990*) specified and estimated a demand system GAITL, which nests both the AIDS and Translog models, and constituted a further generalization of the *Lewbel* (*1989*) demand system. The estimation and statistical testing are based on the Italian household budget data for 1973-1987. The results showed that the new model is superior to the restricted version of AIDS and Translog, and appears to be a statistically significant generalization of the *Lewbel* (*1989*) system. *Eales* (*1994*) developed the Lewbel demand system by nesting both the direct Translog model and the inverse AIDS model.

2.7.4 An Implicitly Directly Additive Demand System (AIDADS)

Rimmer and Powell (*1996*) proposed a new demand system that addresses the issues of flexible Engel responses, and possesses fitted and marginal budget shares that vary non-linearly with the real expenditure. Predicted budget shares from AIDADS are also restricted to the unit simplex by construction. AIDADS is well suited to modeling demands where per capita income levels vary widely across the sample, and to projecting consumer demands in situations were large expenditure growth may be encountered.

Cranfield et al. (*2000*) developed an alternative estimation framework for AIDADS model. *Cranfield et al.* (*2002*) also described the consumer demand patterns across the development spectrum using elasticity estimates from the AIDADS demand system using the maximum likelihood framework and data from 1985 International Comparisons Projects.

A complete overview of the commonly used demand systems has been reviewed in this section. Model selection for this study is based on a comparison and suitability of these models.

2.8 Time Series Data and Cross-Sectional Data

Time series data is a sequence of observations which are recorded at successive (and usually equally spaced) time intervals. There are two types of time series data: the continuous and the discrete time series data. For the continuous time series data, we have an observation at every instant of time; and for the discrete time series data, we have an observation at spaced intervals.

Cross sectional data is a set of observations drawn at a single point in time or in a specified time interval. Household survey data, such as household budget surveys and household expenditure surveys, is a type of cross sectional data, which provide a rich source of data on economic behavior and its links to policy (*Deaton, 1987*). Household expenditure surveys particularly provide information on who buys each good, how much they spend, and consumers' social economic characteristics. The household expenditure survey data are used for research to test theories about household behavior, and to investigate patterns of household demand.

The two types of data have different features. We will encounter different types of econometric problems, when estimating the two different types of data.

The features of the time series data include:

1) Trend component: One of the main features is the trend component. Trend is a long term movement in a time series. Using statistical techniques, we can find out the upward or downward tendency, and the rate of changes with time series data.

2) Seasonal component: Seasonality is the component of variation in a time series, which is dependent on the time of year. It describes any regular fluctuations with a period of less than a year. For example, the prices of various types of fruits and vegetables show seasonal variation.

3) Cyclical component: Especially with the weekly or monthly time series data, the cyclical component describes any regular fluctuations.

4) The analyses based on time series data provide the price and income elasticities of commodity demand.

The econometric problems for time series data analysis include:

1) Autocorrelation: This problem is the serial correlation of the disturbances across periods. It is one of the main problems that always happen with time series data.

2) Multicollinearity: This problem arises when the measured variables are highly intercorrelated, thus lowering the estimation precision.

On the other hand, the cross sectional data have their unique features:

1) The cross sectional microdata are rich with demographic and social economic characteristics of the individuals, and allow researchers to examine the effects of changing lifestyles, tastes, and preferences on commodity demand.

2) Using cross sectional microdata in demand studies avoids the problem of aggregation over consumers, and recognizes the heterogeneity across consumer groups.

3) The analyses based on cross sectional microdata provide the shifters for the demand function associated with changes in socioeconomic and demographic characteristics of the population.

Most of the conventional demand studies are conducted with aggregate time series data. In such studies, it is assumed that choices of heterogeneous consumers can be represented by the choice of one representative consumer, who is a standard utility maximizing individual. Thus, the econometric model is derived from the utility maximization problem of a representative consumer, and model estimation is conducted using aggregate data from groups of households and stores (*Chung and Kaiser, 2002*).

However, a large literature (e.g. *Manchester, 1977*) has showed that this type of modeling may provide misleading conclusions since aggregate data cover the heterogeneity of individual demand. Furthermore, analyses based on the aggregate time-series data provide price and income elasticities, but not shifters for the demand function related to changes in demographic characteristics of the population. The use of household-level microdata can avoid the problem of aggregation over consumers, and the comparison of empirical results suggests that the censored multiple-regression systems provide substantially improved results (*Heien and Wessells, 1990; Heien and Durham, 1991*).

Blundell et al. (1993) suggested that "aggregate data alone are unlikely to provide reliable estimates of structural price and income coefficients". *Heien and Durham* (*1991*) tested the habit formation hypothesis in food consumption using cross sectional data, and compared the results to those from the demand estimation using time series data. Their results demonstrated that the habit effects are overstated by the demand estimation based on time series data.

The analysis of cross sectional microdata, however, often encounters the problem of heteroscedasticity, nonnormality and limited dependent variables. The heteroscedaticity problem versus the nonmormality of the error terms arises when the disturbance variance is not constant across observations. The other problem with the household level microdata is associated with the censored nature of the dependent variables. In household level surveys, not every household will consume something in each of the categories unless the categories are broadly aggregated. The fact that observed expenditures on particular items sometimes take on zero values causes the problem of limited dependent variables.

2.9 Problems with Cross-Sectional Data Estimation

The major econometric problems associated with the demand analysis of cross sectional data will be discussed in this section. Those include the zero expenditure problem and the quality variation issue.

2.9.1 The Problem of Zero Expenditures

A major problem with the household survey data is the zero expenditure problem or a limited dependent variable problem, which comes when the households are observed to consume zero amounts of certain commodities in the survey period.

Zero expenditures were first recognized by *Tobin (1958)*. Micro survey data commonly record purchases over a relatively short period. For example, the Family Food Expenditure Survey (FFES) of Canada is constructed from diary records of expenditures over a two-week period. For such a brief interval, a substantial number of households may report not purchasing a particular product (zero expenditure). The proportion of households that report not purchasing a product during a survey term increases as the category becomes more specific, or as the survey period becomes shorter. For instance, there would be more zero expenditures reported for beef than for meat, and more for ground beef than for beef. The number of zero expenditures would also increase if the survey period was reduced from two weeks to one week.

Several reasons attributed to the occurrence of zero expenditures include: infrequency of purchase, corner solutions, and nonpreference for a good. According to the generating processes of zero expenditures and the features of different commodities, zero expenditures can be categorized into three groups (*Pudney, 1990*):

1) Zero expenditures associated with infrequent consumptions: The observed zeros for most of non-durable goods come from the short duration of the consumer survey. Expenditure surveys are not long enough to record all commodity purchases of a household. For example, people tend to diversify their diet, and not every household will consume a certain food product in the particular survey period. The recorded zeros of a certain food product will be reduced, if the survey period extended. Sometimes the zero purchases of a good is related to its storage. For instance, people purchase sufficient quantities of potatoes, so that they don't need to buy it in a certain period.

2) Zero expenditures associated with economic decisions: households are potential buyers for most luxuries, such as durable goods and various types of entertainment. When certain economic conditions are met, potential buyers will become real consumers. For example, if prices were reduced or income increased sufficiently, the consumption of durable goods would increase.

3) Zero expenditures associated with conscientious abstention: non-consumption is the result of a conscientious rather than an economic decision. Consumers abstain from certain commodities because of health concerns, religious beliefs, or other reasons. For example, vegetarians will not increase their consumption on meat because of a large reduction in meat prices. Thus, households can be divided into different groups of abstainers and non-abstainers (*Pudney, 1990*).

Some studies assume that zero expenditures are most likely due to the short oberservation survey period (*Heien and Pompelli, 1988; Capps and Havlicek, 1984; Capps et al. 1985; Park and Davis, 2001; Chung and Kaiser, 2002; Abdulai, 2002;*

Abdulai and Aubert, 2004; Abdulai et al. 1999), and choose to ignore the zero expenditure problem.

Economists argue that because the zero expenditure problem occurs for different reasons, sample data with zero expenditures cannot be regarded to be equivalent to other types of data in the analysis of survey data. In fact the situation created by zero expenditure in demand analysis is an example of the more general econometric problem of limited dependent variables, which is concerned with truncation and censoring.

Since the 1950's, techniques have been developed in a large literature to deal with the limited dependent variables caused by various assumed reasons. Examples of these techniques include the Tobit model (*Tobin, 1958*), the double hurdle model (*Pudney, 1990*), the Heckman two-step model (*Heckman, 1979*), the full-informaiton maximum-likelihood method (*Amemiya, 1974*), the quasi maximum-likelihood procedure (*Yen and Lin, 2002*), and the simulated maximum-likelihood producure (*Hasan et al. 2001*).

2.9.2 Quality Choices and Unit Price Adjustment

The quality variation issue is related to the characteristics of the household expenditure records. The items recorded in the household expenditures are not homogeneous commodities but represent aggregates of closely related substitutes. So, the expenditure of an item is to be regarded as the sum of various commodities with different qualities and sold at different prices. The different prices paid for the same commodity in the expenditure surveys arise from several causes, including quality differences, regional variations, price discrimination, and accompanying services purchased together with the commodity.

In early demand analysis studies based on cross-sectional data, prices were usually assumed to be constant and all households were assumed to face the same prices (*Allen and Bowley, 1935*; *Prais and Houthakker, 1952*; *George and King, 1971*). The knowledge of price elasticities is normally obtained by the analysis of time-series data which has more price information from intertemporal indices. However, researchers are more interested in discovering the potential to estimate the demand responses with household surveys containing information on the spatial distribution of prices recently. *Pollinsky* (*1977*) demonstrated that misspecification of the price term will lead to biased estimation of price elasticity. In survey data, households report both expenditures and physical quantities, it is possible to divide one by the other to obtain unit values. These unit values are dependent on actual market prices and reflect consumers' quality choice (*Deaton, 1988*).

In the early classic studies by *Houthakker and Prais* (*1952*) and *Prais and Houthakker* (*1955*), the authors analyzed the behavior of the unit values obtained by such division, but the authors were cautious to resist the further temptation to use the calculated "price" to estimate price elasticities. After the 1970's, more researchers (*Timmer and Alderman, 1979*; *Timmer, 1981*; *Chernichovsky and Meesook, 1982*; *Pitt, 1983*) began to regress quantities on unit values, and obtained sensible and pleasing results (*Deaton, 1988*). In 1988, Deaton pointed out that the unit value is not a substitute for a price, since commodity items in household surveys are not a homogeneous commodity, but a collection of commodities. The unit values reflect quality as well as price variation, they are chosen by consumers just as quantities are. The regression of quantity on unit value is therefore a regression of one choice variable on another, and may lead to lack of identification, simultaneity bias and interpretational ambiguity. Moreover, prices will themselves affect the choice of quality, and the substitution will introduce exaggerated price elasticities. *Nelson (1991)* also pointed out that the simple sum of physical quantities in the "quality" literature is found to be a theoretically arbitrary and potentially misleading measure of demand when goods are heterogenous. He further argued the importance of properly adjusting for quality variation depends on the importance of quality effects in the data under examination. For example, rice is a fairly homogeneous commodity in Indonesia, and, hence, *Timmer and Alderman*'s (*1979*) treatment of demand for rice using physical quantities and unit values was theoretically appropriate.

To account for the "quality" effects reflected in the prices in cross-sectional data, *Theil (1952)* and *Houthakker (1952)* developed a model to treat the effects of price and quality using the traditional utility maximization approach to derive the demand functions. In the Houthakker-Theil framework, heterogeneous commodity quantities are defined as the sum of the physical quantities of elementary goods in the group, and "quality" choice is reflected by a separate set of elements in the household utility function. This model was used and adapted by *Deaton (1987, 1988)* and *Cox and Wohlgenant (1986)*. The assumption of this approach is that the household first determines commodity quality through the selection of component goods, and then quantity of the composite commodity. Thus, the household quality decision can be modeled independently of the quantity decision at the commodity level. These decisions are assumed to be based on the income level and other socioeconomic variables of the household.

Generally, the maximization problem in the Houthakker-Theil model is given by:

(2.63) $\max (x_1, \ldots, x_k)$ s.t. $\sum_{i=1}^{k} p_i x_i = Y$,

where x_i is the physical quantity of elementary good i, and the p_i is the corresponding exogenous price, typically unobservable in cross-sectional data. p_i is a function of commodity specific characteristics $b_i = (b_{i1}, \ldots, b_{ik})$, and p_i can be written as:

(2.64) $p_i = \alpha_i + \sum_j \gamma_{ij} b_{ij}$,

where α_i is interpreted as the quantity price, which represents the regional/quarterly mean price, γ_{ij} is the quality price, and $\sum_j \gamma_{ij} b_{ij}$ reflects the sum of component quality prices per unit of xi. Therefore, the price/quality function is specified as:

(2.65) $p_i^* = \sum_j \gamma_{ij} b_{ij} + e_i$

where e_i is the regression residual, and b_{ij} is household characteristics as proxies for household preferences for unobserved quality characteristics. In Cox and Wohlgenant approach, the unit value equation is estimated independently from the demand function using only information on purchasing households. On the other hand, *Wales and Woodland* (*1980*), proposed a two-equation system that includes both a demand relation and the explanation of the unit value. In their approach, the issue of whether or not households purchase a commodity is treated jointly with the quality issue because both measures are subject to sample selectivity bias irrespective of any simultaneity.

Dong et al. (*1998*) developed Wales and Woodland approach and used a bivariate selectivity model to estimate demand curves using cross-sectional data under the assumption that the prices for a single commodity category are not identical across households. Expenditure and unit value functions are included in the two-equation system. *Dong et al.* (*1998*) compared the bivariate model results to those from *Cox and Wohlgenan* (*1986*), and found that the results established simultaneity between the expenditure and prices. They also suggested that the Cox and Wohlgenant approach generally is inappropriate to analyze cross sectional data.

2.10 Previous Studies of Non-Alcoholic Beverages Demand

Basic models and methods that are related to non-alcoholic beverage demand are discussed in previous sections. The literature that specifically conducted on consumer demand for milk and other non-alcoholic beverages in both Canada and other countries will be reviewed in this section.

Much of the focus is on the impacts of informational variables on demand for non-alcoholic beverages in this study. There are many theoretical and empirical models that have implications for non-alcoholic beverages. This section will be guided by the following questions:

1) What kind of data has been used in non-alcoholic beverage studies?
2) What kind of independent variables have been important determinants of non-alcoholic beverage demand in these studies?
3) How have various types of informational variables been modeled in non-alcoholic beverage studies?

2.10.1 Canadian Studies of Milk and Non-Alcoholic Beverage Demand

Demand for milk and other non-alcoholic beverages in Canada have been investigated in a number of studies (Table 2.1). These studies produced estimates of demand responses to prices, income, and advertising expenditures using different demand models and different data types.

Most of the Canadian beverage demand studies have incorporated advertising information into the demand function (*Goddard and Cozzarin, 1992*; *Goddard and Tielu, 1988*; *Goddard et al. 1992*; *Kinnucan, 1987*; *Kinnucan, and Belleza, 1991*; *Kinnucan, 1999*; *Reynolds, 1991*; *Venkateswaran and Kinnucan, 1990*). The Canadian dairy industry is supply managed; a per-unit levy imposed on the premium market to finance the advertising program is shifted entirely to consumers (*Kinnucan, 1999*). A large proportion of the dairy advertising research focused on the optimal generic advertising decision and the social welfare changes associated with generic milk advertising. *Goddard and McCutcheon* (*1993*) found that if advertising is included in the cost of production (COP) formula, the optimal expenditure level is at least 3.5 times higher than when advertising is excluded from the COP.

Another group of studies (*Kinnucan, 1987*; *Venkateswaran and Kinnucan, 1990*; *Goddard and Cozzarin, 1992*; *Goddard and Tielu, 1988*; *Kinnucan and Belleza, 1991*; *Goddard, 1992*) focused on evaluation of the effectiveness of generic advertising campaigns. *Goddard et al.* (*1992*) analyzed the impact of generic milk advertising on demand for fluid milk and other cold non-alcoholic beverages in Ontario, using both the single equation approach and the Translog demand system. The products considered in this study for were fluid milk, soft drinks, tomato juice, apple juice, and orange juice. In the single equation approach, the fluid milk demand is modeled as a function of retail prices of fluid milk and other non-alcoholic beverages, Ontario per capita disposable income, average age of Ontario population in every year, media advertising expenditures for fluid milk in Ontario, seasonal dummy variables, dummy variables to remove the effect of an outlier, and the lagged dependent variables. The estimated parameters have anticipated signs (e.g. positive relationships between milk consumption and juice prices, income, advertising expenditure, and lagged milk consumption; declining milk demand in summer time; negative relationship between milk demand and population age) in all cases except for advertising. Income, age, seasonality, and dynamic effects are significant at 1 percent level. Fluid milk has negative own-price elasticity and positive cross-price and income elasticities. Fluid milk demand appears to have a significant seasonality. The estimated model is found highly sensitive to the specification and sample data. The demand system approach is based on the assumption of a two-stage budgeting process. The first stage of the demand model was specified in a logarithmic form. In the second stage, a Translog demand function was used to describe various beverages demand determined by advertising, demographics, prices and the total expenditure. Results show that prices, advertising and habit formation are significant factors affecting consumption of non-alcoholic beverages in Ontario. Income appears to be an unimportant term; and the five negative own-price elasticities indicate inelastic demand for the five beverage types. The negative cross-price elasticities suggest that these beverages are gross complements for Ontario consumers. Except for orange juice, all own-advertising elasticities are positive; cross advertising elasticities indicate ambiguous effects of competitive advertising. Overall, milk advertising significantly affects the demand for milk and related beverages. Advertising conducted by the Ontario Milk Marketing Board appears to have increased milk demand sufficiently to offset the costs of the program.

Most of the reviewed literature used time series data in estimating milk and other beverage demand. Very few beverage studies have been conducted with cross sectional data. *Ryenolds (1991)* analyzed the consumer choices among standard and fat-reduced fluid milk using Canadian Family Food Expenditure Survey data, and applying a double hurdle model and a logit choice model. In the double hurdle model, the dependent variables are expenditure shares of total fluid milk, standard milk, lowfat milk and skim milk; the independent variables include prices of the various fluid milk items, household income and size, age, sex, and education and marital status of the household head, urban/rural and provincial location of the household, household receipt of social assistance benefits, the number of breakfast meals taken away from home, fluid milk advertising expenditures, and prices of orange juice and carbonated drinks. The implicit price of a given fluid milk type for a household which has non-zero consumption was obtained by dividing expenditures by quantity purchased. Prices for households, which have zero milk expenditures, were obtained from regressing the previous implicit price on household income, provincial dummies, seasonal dummies, and an urbanization dummy. Prices of orange juice and carbonated drinks were found to be statistically insignificant in all the demand specifications. Results from the double hurdle model suggest that the impacts of some socioeconomic and demographic variables were not homogeneous across fluid milk types. Household income has a positive and significant impact on both the participation decision (the decision on whether to purchase or not) and the consumption decision (the decision on how much to purchase). Own price variables have a significant negative impact on the consumption decision. Advertising has a significant and positive impact on the participation decision and a positive but not as significant impact on the consumption decision. The number of breakfast meals taken away from home has a significant negative impact on at home fluid milk consumption. Households which receive social assistance benefits are less likely to purchase fluid milk than nonrecipients are; and even when they purchase, they tend to buy a smaller amount than nonrecipients do. From the results, standard milk appears to be a substitute for lowfat milk with respect to the participation decision, but a compliment in the consumption decision; skim milk is a substitute for lowfat milk in both the participation decision; and skim milk appears to be a compliment in the participation decision but a substitute in the consumption decision. Other socioeconomic and demographic variables, such as household size, age, sex, marital status, education level, urbanization and provincial location, have significant impacts on either the participation decision or the consumption decision. The estimates from the logit model indicated that household income, sex, the educational level of the household head, the marital status, household composition, welfare assistance recipients, the urban/rural and provincial location of the household, and the price of fat-reduced fluid milk had a significant impact on household choices between fat-reduced milk and standard milk.

Table 2.1 Previous demand studies for non-alcoholic beverages in Canada.

Number	Author	Study (demand systems, data and time period)	What and how variables included	Commodities
1	Goddard and Cozzarin (1992)	This paper evaluates the impact of national advertising campaigns in Canada using the Translog model and the AIDS model for the annual data from 1967 to 1986.	Advertising variables are modeled as an independent demand shifter.	Beef, pork, chicken, turkey, eggs, milk, butter, cheese, and margarine.
2	Goddard, and Tielu (1988)	Advertising effectiveness of the cold, nonalcoholic beverage in Ontario. Translog demand model and quarterly data from 1971:1 to 1984:4 are used. Increasing advertising expenditure on fluid milk would increase fluid milk revenue net of advertising costs to the dairy industry. Fluid milk demand is little affected by advertising of other goods, which are effective on the demand for other beverages.	Advertising expenditures and the habit formation is incorporated.	Fluid milk, soft drinks, tomato juice, apple juice and orange juice.
3	Goddard, Kinnucan, Tielu and Belleza (1992)	Generic milk advertising impact analysis in Ontario using both a single equation and a two-stage Translog system. Quarterly data from 1971:1 to 1984:4. Advertising fluid milk not only increases the demand for fluid milk, it increases the demand for soft drinks and tomato juice and decrease the demand for orange juice and apple juice. Advertising program appears to have increased milk demand sufficiently to offset the costs of the program.	Prices, advertising expenditures of different types of nonalcoholic beverages, and income, age, and lagged dependent variables.	Five nonalcoholic beverages: fluid milk, soft drinks, tomato juice, orange juice and apple juice.
4	Hassan, and Sahi (1976)	Consumer demand for dairy products in Canada. Single equations estimated using Zellner's "seemingly unrelated regressions" (ZSUR) and ordinary least square. Annual data from 1958 to 1972. Retail demand for each diary product is inelastic to both price and income.	Prices, per capita disposable income, time trend.	Fluid milk, butter, cheese and skim milk powder.
5	Kinnucan (1987)	Advertising effectiveness in Buffalo and New York market. Annual data from 1978-1980, and the first six months data in 1981.	pendent variables: advertising expenditures, personal income, milk price, cola price index, coffee price index and seasonal change.	Milk.

Table 2.1 Previous demand studies for non-alcoholic beverages in Canada (continuation).

Number	Author	Study (demand systems, data and time period)	What and how variables included	Commodities
6	Kinnucan, and Belleza (1978)	Economic impacts of advertising, and compares estimates of ads elasticities based on advertising tracking data and OMMB data series. Quarterly data covering the period of 1973-84 was used. Double-log demand equations.	Seasonal dummies, disposable personal income, age, advertising expenditures, milk price, orange juice price, lagged dependent variable.	Milk
7	Kinnucan (1999)	Simulation of the optimal advertising decision subject to fixed prices and fixed quantity. Annual data from 1986-89 and 1996.		Milk.
8	Lee, Brown, and Seale (1992)	Demand relationships among fresh fruit and juices in Canada, using Rotterdam model, CBS model and both the weak separability and strong separability. Annual data from 1960 to 1987. Results show that if Canadian consumers were to allocate larger portions of their budgets to the consumption of fresh fruit and juices, expenditure shares on oranges and apples would increase, with fresh oranges benefiting the most.		Fruits and fruit juice: orange, grapefruit, apples, bananas, orange juice, apple juice and tomato juice.
9	Reynolds (1991)	1986 FFES data, Double hurdle model. The implicit prices were obtained by dividing expenditures by quantity purchased. Results show that various demographics are important in consumer's purchasing decisions.	Prices of various fluid milk, household income and size, age, sex and education of the household head, marital status of the household, urban/rural and provincial location of the household, household receipt of social assistance benefits, and other demographics.	Total fluid milk, standard milk, lowfat milk and skim milk
10	Venkateswaran and Kinnucan (1990)	The response of fluid milk sales to generic advertising and optimal advertising expenditures. Single equations. Quarterly data from 1973:1 to 1988:4. Results show that Generic fluid milk advertising has significantly increased milk consumption.	Price of milk, price of orange juice, milk advertising expenditures, disposable personal income, average age of Ontario population and seasonal dummies.	Regular, low-fat, skim and chocolate milk.

2.10.2 Studies of Non-Alcoholic Beverage Demand in Other Countries

There is a large literature on milk and other non-alcoholic beverage demand in the U.S. and other countries, such as Japan and European Union.

According to USDA, consumption of lowfat and skim milk has increased substantially over the past decades. This observed trend has motivated researchers to conduct structural studies of fluid milk demand and to identify various demand shifters related to fluid milk consumption in the U.S. (*Gould et al. 1990*; *Miles et al. 1995*). These demand shifters include: increased consumers concerns about cholesterol and animal fats, and consumer demographic changes.

Other non-alcoholic beverages, such as fruit juices, soft drinks, and coffee and tea, have been included into the demand studies as well (*Watanabe et al. 1997*; *Acharya, 1996*; *Brown et al. 1994*). *Watanabe et al.* (*1997*) investigated consumer characteristics associated with preferences toward milk products and other non-alcoholic beverages, using the survey data conducted by the National Milk Promotion Association of Japan. Their results indicated that men, middle-aged people, and people with no calcium concerns prefer soda and alcoholic beverages to milk beverages, while younger people, larger families, and people with calcium concerns drank more milk more often. The results also suggested that non-milk drinkers, older people, people with no calcium concerns, and men were less inclined to consume cheese and yogurt, and stronger health concerns increased demand for milk and dairy products.

(i) Incorporating Advertising into the Non-alcoholic Beverages Demand Study

A group of studies focused on effectiveness of advertising on milk and other non-alcoholic beverage demand (*Lenz et al. 1998*; *Kaiser et al. 1994*; *Vande Kamp and Kaiser, 1999*; *Tomek and Kaiser, 1999*; *Reberte et al. 1996*; *Capps and Schmitz, 1991*; *Liu and Forker, 1988*). These studies revealed that milk and other non-alcoholic consumption more or less had been influenced by advertising expenditures (include generic and brand advertising). *Xiao et al.* (*1998*) investigated advertising, the structural change and U.S. demand for milk, juices, soft drinks, and coffee and tea. Estimation results showed that beverage consumption in the U.S. is affected by both advertising and the structural change. All the own-price and expenditure coefficients were negative and significant. The positive cross-price coefficients suggested that the beverages were conditional net substitutes. Most of the advertising and trend coefficients in the conditional demand equations were significant; most of the demographic coefficients were not. For example, age was significant only in the milk demand equation and the group demand equation; food-away-from-home was significant only in the milk demand equation; the trend terms were significant in all equations except juices and group demand. In terms of elasticities, coffee and tea appeared to be the most affected by other commodity advertising expenditures, and milk the least; juice advertising appeared to exert the largest influence within the beverage market, and milk advertising the least. The age and food-away-from-home elasticities were only significant for milk. Except for juices, all the conditional trend elasticiites were significant and absolutely larger than the price, income, advertising, and demographic elasticities. This study concluded that the structural change was the main factor at work on the consumption pattern, although the relative prices, income, and advertising also had influences on this pattern. *Kaiser and Reberte (1996)* examined the structure of milk demand by investigating differences in advertising effects on whole, lowfat, and skim milk demands. *Rickertsen and Gustavsen (2002)* found that Norwegain fluid milk consumption had declined steadily over the last twenty years, despite the dairy industry spending increasing amounts of money on advertising. They then estimated the advertising effects on demand for fluid milk and non-alcoholic beverages using an AIDS model.

In most cases, advertising variables enter into the consumer's utility function as a demand shifter (*Xiao et al. 1998; Schmit et al. 2001; Chung and Kaiser, 2002*). Advertising intensity is also modeled as scaling, translating variables (*Brown, 1995*), augmenting terms (*Gao and Lee, 1995*), or an input into the household production function (*Liu and Forker, 1988*). *Brown (1995)* examined the impacts of nonprice and nonincome variables on demand for grapefruit and other juics. Advertising variables are modeled as scaling, translating and the combined scaling-translating hypothesis in a Rotterdam model. The combined scaling-translating specification is accepted against an unrestricted specification, while the other specifications are rejected. *Liu and Forker (1988)* modeled the advertising intensity as an input into the household production function to estimate the demand effects of the generic fluid milk advertising program in New York City. *Gao and Lee (1995)* measured the impact of retail store advertising on three fruit juice consumption using an extended Rotterdam model, assuming that advertising affects consumers' latent perceptions, which in turn influences their purchasing behaviors.

(ii) Using Cross-sectional Data in Non-alcoholic Beverage Demand Study

Most of the conventional beverages studies are conducted with aggregate time series data. However the demand analyses based on the aggregate time-series data are not satisfactory, because aggregate data usually mask many changes in the sub-groups (*Manchester, 1977*). The use of household-level microdata can avoid the problem of aggregation over consumers and provides a large and comprehensive statistical sample (*Heien and Wessells, 1990*). Certain problems such as zero expenditures and implicit prices for the missing values are considered in some of the demand studies using microdata.

Examples of beverage demand studies conducted by using cross-sectional household survey data are *Abdulai et al.* (*1999*), *Bewley* (*1987*) and *Chung and Kaiser* (*2002*). The problems of zero expenditures and the implicit prices of the missing observations are ignored in these studies. *Chung and Kaiser* (*2002*) examined how seriously the data aggregation may affect the evaluation of generic advertising. They derived a statistics procedure and showed that the aggregation bias exists as long as the covariance between marketing variables and corresponding parameters are nonzero, or the linearly aggregated data are used for non-linear models. The derived procedure was applied to the evaluation of U.S. milk advertising programs. Significant aggregation bias existed in three estimated variables: price, income, and advertising. *Heien and Wessells* (*1988*) used the 1977-78 USDA Household Food Consumption Survey data to estimate demand for dairy products in the U.S. They did not consider the zero purchase problem as it minimized since over 70% of the observed budget shares are nonzeros.

Gould (1996) examined U.S. demand for three types of fluid milk with different fat contents using penal data and a Translog model. Own- and cross-price elasticities and substitution elasticities are estimated along with household demographic effects.

Yen and Lin (2002) investigated milk, soft drink and juice consumption for children and adolescents in the U.S., using the quasi maximum likelihood method and the maximum likelihood method. The data is from the 1994-1996 USDA Continuing Survey of Food Intakes by Individuals (CSFII). From the data, several categories of beverages (include milk, carbonated soft drinks, fruit drinks and ades, fruit juices, and vegetable juices) are aggregated into three categories: milk, soft drinks (carbonated soft drinks, fruit drinks and ades), juice (fruit and vegetable juice) according to their nutritional profiles of these beverages. The independent variables include age, income, number of hours watching TV over 2 days, number of survey days falling on weekend, meal planner's education, individual characteristics (e.g. sex, country of birth, geographic region, and race). Results showed that the consumption of soft drinks increasesed and consumption of milk decreased as a child became older. The changing beverage consumption among children may have contributed to the increased prevalence in children's overweight and obesity. Income, TV watching, gender, race, and other demographic variables also played significant roles in determining beverage consumption. For example, soft drink consumption was positively related to TV watching; during weekends, children tended to consume more soft drinks and less milk; and girls consumed less milk than boys. These findings suggested a more active role for government campaigns and parents nutrition education in improving children's food choices.

Schmit et al. (2001) studied the effectiveness of generic advertising on the household demand for fluid milk and cheese, using a panel data for the period 1997-1999. A two-step sample selection model is used to estimate household demand equations to examined the advertising effects on the probability of purchase and on changes in the level of consumption.

2.11 Summary

The purpose of this section is to describe the technique choice criteria, summarize previous sections, and select the methodology that will be applied in this study. The criteria for selectin an appropriate technique to fulfill the study objectives include factors such as the consistency of the demand system to demand theory, the flexibility of the demand system, the estimation difficulty, the time constraint, and the available data.

In this chapter, the classical consumer demand theory, which is the basis of the whole thesis, was reviewed first.

Secondly, the general consumer demand model specification is described, including discussions about the single equation versus the demand system approach, five types of flexible demand systems, and how to incorporate information variables into the consumer utility function. From the review, a demand system approach is more constrained by the budget constraint through the adding-up condition (expenditure shares for goods add up to no more than the total expenditure), than a single equation approach is. Also, the cross-price, cross-information effectiveness can be calculated in the multiple commodity demand system. Therefore, a demand system approach will be employed in this thesis. From the literature review, a blockwise framework is appropriate in investigating different characters for detained beverage products. The AIDS model (*Deaton and Muellbauer, 1980*), the Translog model (*Christensen et al. 1975*), Lewbel flexible demand system (*Lewbel, 1989*) and AIDADS demand system (*Rimer and Powell, 1996*) are reviewed in this chapter as well. The Lewbel model and the AIDS model are selected for the general beverage demand analysis and blockwise demand analysis respectively.

The debate of how to incorporate informational variables into the utility function, and six different methods of integrating information variables into a demand function are reviewed. In this study, various informational variables, such as beverage health information and advertising, is assumed to shift the position of the demand curve and hence is incorporated as a shift parameter. This method has been commonly used in examining the effectiveness of information intensity on consumer demand (*Goddard and Cozzarin, 1992*).

Two types of data that could be used in this study are also discussed in this chapter. One is time series data, which is used in most of the conventional demand study. The other is cross-sectional micro data. Demand studies based on microdata provide better insights on how sub-groups within the population behave. Microeconomic models enable better estimation of demand parameters and more accurate forecasts than those assuming average effects for all members of the population based on aggregate data (*Manchester, 1977*). Analysis of microdata always encounters econometric problems associated with the censored nature of the dependent variables. However, the focus of this study is to investigate the effects of informational variables on Canadian demand for non-alcoholic beverages. Therefore, this thesis will follow some of the previous studies without addressing the sample selection problem (*Heien and Pompelli, 1988; Capps and Havlicek, 1984; Capps et al. 1985; Park and Davis, 2001; Chung and Kaiser, 2002; Abdulai, 2002; Abdulai and Aubert, 2004; Abdulai et al. 1999*).

Chapter 3 Conceptual and Empirical Framework

3.1 Introduction

The objectives of this thesis are defined in Chapter One, and a related literature review is conducted in Chapter Two. Based on the discussion in the literature review, the conceptual and empirical framework that will be applied in this study are constructed in this chapter. The outline of this chapter is as follows:

1) The model specification and the variable selection for the non-alcoholic beverage demand models;
2) A blockwise dependent framework developed to account for the difference in demand characters for different types of milk;
3) The method of constructing the beverage health information indices;
4) A complete *Lewbel* (*1989*) model for beverage demand incorporating informational variables and demographic variables;
5) A blockwise dependent AIDS model;
6) Calculation of elasticities.

3.2 Consumer Demand for Non-Alcoholic Beverages

Applications of consumer theory normally assume weak separability. The concept of weak separability allows for the disaggregation of all commodities into components made up of commodities, for which the marginal rate of substitution is independent of quantities of other commodities consumed. The consumption of a particular group of commodities can then be determined in a two-stage process. In the first stage, the income allocated to a particular group of commodities is determined through the allocation of total income across utilities generated by a number of similarly aggregated groups of commodities (e.g. food, clothing, shelters etc.). In the second stage, the income allocated to the group of commodities is distributed across the individual commodities in the group. Both stages are determined by a simultaneous utility maximization procedure.

The problem addressed in this study is the determination of consumption of non-alcoholic beverages in Canada. A two-stage budgeting approach is taken, and the weak separability between these beverages and all other commodities in the first stage is a maintained assumption. At the second stage, it is assumed that consumers make the decision on what type of beverages to consume. Therefore, the first stage of the demand system can be specified as a log-log relationship between the total real expenditure on non-alcoholic beverages and the independent explanatory variables, such as prices, real advertising expenditures, household income, and other socioeconomic and demographic variables. The general form of the first stage equation is expressed as:

(3.1) $TEXP_t = \sum_i P_i X_i = f(P, Y, A, D)$, $i = 1, 2, \ldots, n$ number of individual commodities, where

P_i = real price of individual beverage i;

X_i = quantity consumed of beverage i;

P = expenditure share weighted price index for all types of beverages;

Y = total expenditure on beverages;

A = real advertising expenditure of various types of beverages;

D = a vector of social economic and demographic variables of the household.

At the second stage, it is assumed that consumers make the decision on what type of beverages to consume. Total expenditure in the first stage is allocated among the various classes of beverage products, such as fluid milk, fruit juices, vegetable juices, soft drinks, and coffee and tea. The second stage of the model will be composed of a system of equations explaining the demand for each type of non-alcoholic beverage as functions of beverage prices, total expenditure on beverages, real advertising expenditures, health information indices, and socioeconomic and demographic variables. The general form of the second stage equations can be expressed as:

(3.2) $w_i = P_i X_i / TEXP = g(P_i, Y, A, HI, D)$, $i = 1, 2, \ldots, n$ number of individual commodity, where

w_i = the expenditure share for the ith beverage product,

HI = health index related to beverage consumption.

Several categories of non-alcoholic beverages are considered in this study, including fluid milk, soft drinks, fruit juice, vegetable juice, and coffee and tea.

Based on the Canadian Family Food Expenditure Survey (FFES) data, each of the above non-alcoholic beverage categories includes several detailed product items. The fluid milk includes whole milk, low-fat milk (1%), low-fat milk (2%), skim milk, and specialty milk products; the specialty milk includes lactose reduced milk, sterilized milk, acidophilus milk and Lactaid (TM).

The fruit juice category includes apple juice (sweet cider), grapefruit juice (sparkling grapefruit juice), orange juice, other fruit juice (pineapple juice, unfermented grape juice, blended fruit juice, pure or natural papaya juice, wild berry juices, pure or natural citrus fruit juice, pure or natural apricot juice, prune nectar, lime juice, lemon juice, grape nectar, grape juice for wine preparation, blended orange and grapefruit juice, apricot nectar, passion fruit juice, cranberry juice, and 5 Alive Juice (TM)), concentrated orange juice, and other concentrated fruit juice (concentrated blended fruit juice, pure or natural citrus fruit juice concentrates, pineapple juice concentrates, lime juice concentrates, lemon juice concentrates, concentrated grapefruit juice, apple juice concentrates, grape juice concentrates and Tropical Sun (TM)).

The vegetable juice category includes tomato juice and other vegetable juice (carrot juice, mixed vegetable juice, beefamato clamato and V8 juice).

Detailed items in the carbonated beverage category include soda water, tonic water, root beer, low-calorie carbonated beverages, cola beverage, Colossal Cooler (TM) and Big Gulp (TM).

Fruit drinks include squash, tropical fruit drink, orange cordial, saloa, orange drink, lime cordial, lemonade, lemonade-frozen, fruit concentrates-frozen, apple drink, limeade-frozen, Honeydew(TM)-frozen, Ribena (TM), Gatorade (TM) fruit drink and Slurpee (TM).

Other non-alcoholic beverages include mineral waters, natural and artificial, carbonated or still, non-alcoholic beer and wine (0.5% or less alcohol), liquid iced tea, lemon barley water, liquid coffee (hot or iced) and Nantan Water(TM). In total 19 categories of non-alcoholic beverage products from the FFES data are included in this study.

3.3 Blockwise Dependence and the Utility Tree

One of the challenges for investigating household demand for non-alcoholic beverages how to aggregate the product items, and to what extent they should be aggregated.

Most of the previous beverage demand studies (*Chung and Kaiser, 2002; Yen and Lin, 2002*) aggregated different types of fluid milk, such as whole milk, low-fat milk and skim milk, into a general "milk" product. For example, in the study of *Yen and Lin (2002)*, five broad categories of beverages are aggregated into three categories, which are milk, soft drinks (carbonated soft drinks, fruit drinks, and ades), and juice (fruit and vegetable juice). The economic assumption for this aggregation method is that all prices of the detailed items to be aggregated move together by the same proportion. The share equation for milk expenditure is expressed as: $w_{milk} = f\left(p_{milk}, p_{juice}, p_{softdrinks}, Y\right)$, where p's are the unit values of different types of beverages, Y is the total expenditure spent on beverages.

This assumption seems strong for the case of non-alcoholic beverages, and it covers the relationships between the detailed product items, especially for milk types with different fat contents. For example, low-fat milk, skim milk and whole milk are totally different in consumption trends. Over the last ten years, there has been a significant switch from the consumption of homogenized (whole) milk to skimmed and partly skimmed milk. Consumption of homogenized milk has dropped from 5.23 million hectoliters in 1992 to only 4.2 million hectoliters in 2002. Consumption of 2% milk fell approximately 18.3%, decreasing to 12.5 million hectoliters in 2002 from 15.32 million hectoliters in 1992. Consumption of 1% milk for 2002 is recorded as 5.36 million hectoliters, and it is expected that sales in this milk category will continue to grow mostly at the expense of 2% milk. From 1992 to 2002, the annual consumption of skim milk has increased from 1.78 to 2.76 million hectoliters. Examples of fluid milk consumption pattern analysis include the study of *Reynolds (1991)*, *Briz et al. (1998)* and *Schmit et al. (2001)*. *Reynolds (1991)* examined the demand for standard milk, low fat milk (2%) and skim milk, using the FFES data conducted by Statistics Canada; *Briz et al. (1998)* analyzed the Spain domestic demand for whole milk, skim milk and all other fluid milk; *Schimt et al. (2001)* investigated U.S. demand for fluid milk, which is disaggregated into whole milk, reduced fat (2%), light milk (0.5%-1%), and skim milk, using ACNielsen panel data. The individual consumption trends will be ignored by simply aggregating whole milk, skimmed milk and partly skimmed milk into one general milk category. Therefore, it is appropriate to describe the preference structure as uniform substitutes and to introduce a blockwise dependent framework for this study (*Theil, 1980*).

In this study, the concept of blockwise dependence is used to set up the possible utility trees for non-alcoholic beverage consumption. Consumers allocate their total expenditure between beverages and all other commodities in the first stage. In the second stage, they make purchase decisions among different types of milk, fruit juices, vegetable juices, soft drinks, and coffee and tea. The utility tree is demonstrated as Figure 3.1.

Consumption share equations can be constructed for a complete set of 19 products under a blockwise dependent structure. For example, the share equation for 2% milk can be represented as:

(3.3) $$w_{2\%\,milk} = f\left(p_{1\%\,milk}, p_{2\%\,milk}, p_{wholemilk}, p_{specialtymilk}, p_{fruitjuice}, p_{vegetablejuice}, p_{softdrinks}, p_{coffee\,\&\,tea}, A, HI, D, Y\right)$$

However, in the real empirical estimation process, more work needs to be done on aggregating products to save degrees of freedom. First, the large number of estimated parameters will be cumbersome for the estimation. For example, even without considering informational variables, more than 100 parameters will be estimated only for

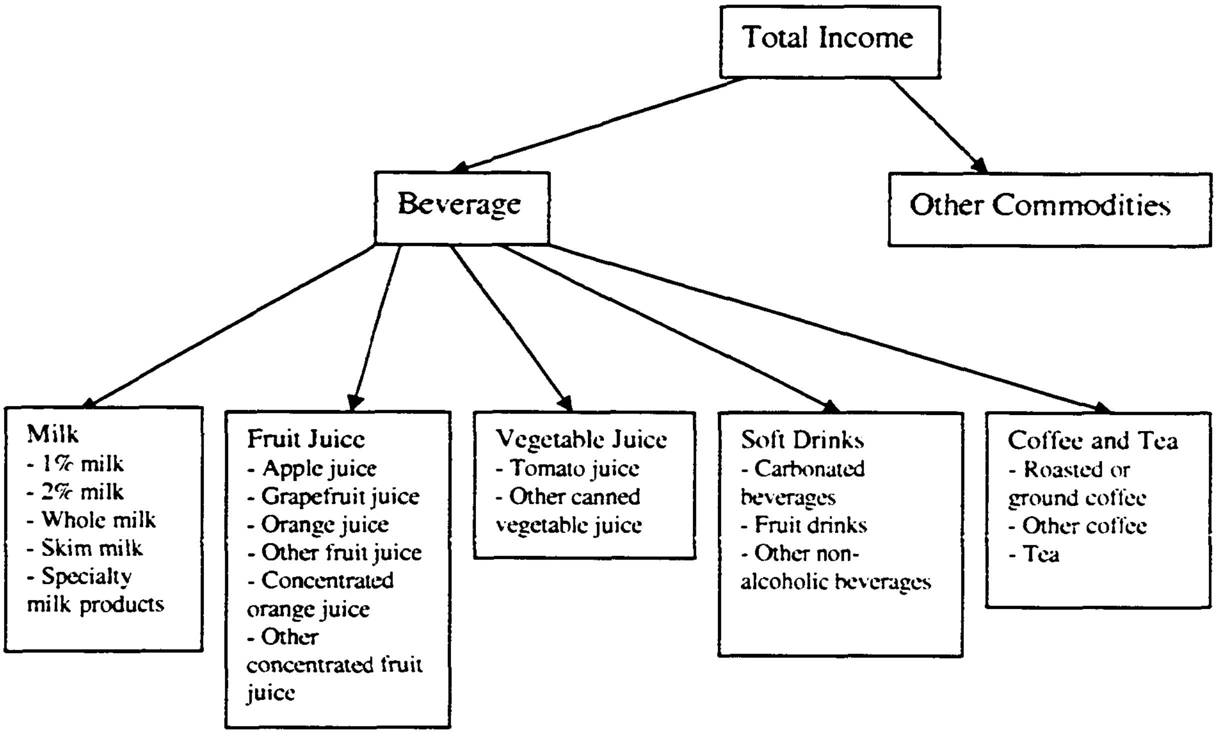


Figure 3.1 Utility Tree for Non-alcoholic Beverage Consumption

prices. Second, some of the beverage expenditure shares are relatively small, and this will result in a large quantity of zero dependent variables. Based on the FFES data (1996 and 2001), the expenditure shares can be calculated for the 19 beverage products as the percentage of the expenditure of a specific beverage product to the total beverage expenditure (Table 3.1 and 3.2). The expenditure share for tomato juice is small, accounting for less than 1% of the total beverage expenditure for the 2001 sample. Other beverages, including skim milk, specialty milk, apple juice, grapefruit juice, concentrated fruit juice, fruit drinks, other nonalcoholic beverages, vegetable juice, roasted or ground coffee, and other coffee and tea, have less than 5% of the total beverage expenditure in the 2001 sample. Some of the beverage expenditure shares are relatively large. For example, both 2% milk and carbonated beverages have expenditure shares greater than 17%; each of 1% milk, whole milk, orange juice and other fruit juice has expenditure shares greater than 5% but less than 10% in the 2001 sample. The 1996 sample shows similar consumption patterns in terms of the expenditure shares.

Thus, to save degrees of freedom, it is necessary to aggregate the products, which have relatively small expenditure shares, according to both nutritional profiles and expenditure shares. 1% milk, skim milk and specialty milk are aggregated as "other milk", which is composed of further processed milk products. Apple juice, grapefruit juice, orange juice, other fruit juice, concentrated orange juice and concentrated other fruit juice are aggregated into fruit juice. Carbonated beverages, fruit drinks and other nonalcoholic beverages are aggregated as soft drinks. Roasted or ground coffee, other coffee, and tea are aggregated as coffee and tea.

Table 3.1 Non-alcoholic beverage expenditure shares, 1996.

Product	Mean of expenditure share
1%milk	0.0731
whole milk	0.0619
2%milk	0.2093
skim milk	0.0451
specialty milk	0.0056
apple juice	0.0284
grapefruit juice	0.0051
orange juice	0.0464
other fruit juice	0.0533
concentrated orange juice	0.0307
concentrated other fruit juice	0.0185
carbonated beverages	0.1903
fruit drinks	0.0406
other nonalcoholic beverages	0.0253
tomato juice	0.0093
other canned vegetable juice	0.0136
roasted or ground coffee	0.0429

other coffee	0.0624
tea	0.0381

Data source: 1996 Food Expenditure Survey, Statistics Canada.

Table 3.2 Non-alcoholic beverage expenditure shares, 2001.

Product	Mean of expenditure share
1%milk	0.0857
whole milk	0.0582
2%milk	0.1743
skim milk	0.0450
specialty milk	0.0061
apple juice	0.0230
grapefruit juice	0.0051
orange juice	0.0551
other fruit juice	0.0816
concentrated orange juice	0.0157
concentrated other fruit juice	0.0217
carbonated beverages	0.1730
fruit drinks	0.0321
other nonalcoholic beverages	0.0423
tomato juice	0.0079
other canned vegetable juice	0.0161
roasted or ground coffee	0.0409
other coffee	0.0407
tea	0.0323

Data source: 2001 Food Expenditure Survey, Statistics Canada.

Therefore, the blockwise dependent beverage demand system includes whole milk, 2% milk, other milk (including light milk (1%), skim milk (0%) and specialty milk), fruit juice, vegetable juice, soft drinks, and coffee and tea. The seven expenditure share equations in the second stage can expressed as:

(3.4.1) $$w_{wholemilk} = f\left(p_{wholemilk}, p_{2\%\,milk}, p_{othermilk}, p_{fruitjuice}, p_{vegetablejuice}, p_{softdrinks}, p_{coffee,tea}, A, HI, D, Y\right)$$

(3.4.2) $$w_{2\%\,milk} = f\left(p_{wholemilk}, p_{2\%\,milk}, p_{othermilk}, p_{fruitjuice}, p_{vegetablejuice}, p_{softdrinks}, p_{coffee,tea}, A, HI, D, Y\right)$$

(3.4.3) $$w_{othermilk} = f\left(p_{wholemilk}, p_{2\%\,milk}, p_{othermilk}, p_{fruitjuice}, p_{vegetablejuice}, p_{softdrinks}, p_{coffee,tea}, A, HI, D, Y\right)$$

(3.4.4) $$w_{fruitjuice} = f\left(p_{milk}, p_{fruitjuice}, p_{vegetablejuice}, p_{softdrinks}, p_{coffee,tea}, A, HI, D, Y\right)$$

(3.4.5) $$w_{vegetablejuice} = f\left(p_{milk}, p_{fruitjuice}, p_{vegetablejuice}, p_{softdrinks}, p_{coffee,tea}, A, HI, D, Y\right)$$

(3.4.6) $$w_{softdrinks} = f\left(p_{milk}, p_{fruitjuice}, p_{vegetablejuice}, p_{softdrinks}, p_{coffee,tea}, A, HI, D, Y\right)$$

(3.4.7) $$w_{coffee,tea} = f\left(p_{milk}, p_{fruitjuice}, p_{vegetablejuice}, p_{softdrinks}, p_{coffee,tea}, A, HI, D, Y\right)$$

3.4 Incorporation of Information Variables and Demographic Variables

In the basic utility theory framework introduced in Chapter Two, the consumer's utility is viewed as a function of the quantities of goods and services purchased. One important assumption in the basic consumer choice model is perfect information on goods and services. The demand function excludes the complication introduced by changes in product information, consumer demographics and habits. However, it is unrealistic to assume consumers' information perfection in the real demand decision process. If consumers receive new information about a good, it would be expected that their consumption decisions would change. Better information may allow individuals to increase their utility from consuming goods and services (*Teisl et al. 2001*).

From the literature review (Chapter Two), there are various ways of measuring the impact of information and demographic variables on consumer demand. For this study, information variables (e.g. various types of health information indices and advertising expenditures) enter the consumer's utility function as a shifter. The impacts of the information variables on the consumer demand can be observed from the interaction between the information (e.g. advertising expenditures) and the demand for information influenced products. This interaction could be specified as a shift of the demand curve, a change in the slope of the demand curve or a change in the shape of the demand curve (*Goddard et al. 1992*). In this study, information variables are assumed to shift the position of the demand curve and hence are incorporated as shift parameters. This way of incorporating information variables into the consumer utility function, raises theoretical problems, which will not be solved in this study. For example, the pre- and post-advertising consumer welfare measures are not on the same scale (*Dixit and Norman, 1978*). The way of incorporating information variables as shifters in demand functions is commonly used in examining the impacts of advertising expenditures, health information and nutritional information on food demand (e.g. *Goddard and Cozzarin, 1992*; *Kinnucan et al. 1997*).

For the case of the beverage health information, it can be hypothesized that positive milk health information (e.g. "milk is good for teeth and bone health") would increase the expenditure on the informed products, and in turn increase the total beverage expenditure. This effect on the changes of the total beverage expenditure could be captured by the first stage of the two-stage demand system. Alternatively, as the health information is always targeted to specific products, it is possible that consumers will not change the overall consumption of beverages but change the relative shares for each beverage type (e.g. from soft drinks to milk). Thus, in a two-stage demand system, the effects of health information on the relative shares of beverages could be captured by the second stage. A further hypothesis is that the demand in both stages of the system could be affected by any particular health information. Hence, the effects of health information could be captured by the combined effects of the two stages.

Similar hypotheses could be applied for advertising expenditure variables. One can hypothesize that the generic milk advertising (e.g. "drink more milk") would increase the expenditure on milk products leading the increase of total expenditure on beverages.

Also, it can be hypothesized that the milk advertising will affect the consumer demand for both milk and other beverages, causing the shift from another beverage to milk products. However, if milk brand advertising is targeted towards a particular milk type (e.g. vitamin-enriched milk), it is possible that consumers will change the relative shares from each milk products. This effect will be better described in a blockwise dependent beverage demand system with different milk types as separated expenditure shares.

Demographic variables are hypothesized to have influences on consumer demand for beverages. For example, household with children under 18 years old would be expected to consume more milk than other types of households do. There are several ways to integrate demographic variables into the demand function (Chapter Two). The method of treating demographic variables as an exogenous explanatory variable will be employed in this study.

Therefore, as demand shifters, informational variables (beverage health information and advertising expenditures) and demographic variables will be modeled into both the general beverage demand system and the blockwise dependent beverage demand system.

3.5 Measurement of Health Information

Based on the results of previous agricultural food empirical studies, there is a reasonable expectation that health concerns do affect consumer behavior for food. Some studies that used a health information indicator have found that it can be a more significant determinant of demand than prices and advertising.

Hence, the goal in this section is to develop an indicator of the health information for milk and other non-alcoholic beverages, in order to measure the impact of health information on household beverage consumption in Canada.

3.5.1 Health Information Related to Non-Alcoholic Beverage Consumption

In Canada, one of the major health concerns is osteoporosis, which is the weakening of bones caused by a reduction in the actual amount of bone matter. Osteoporotic fractures incidence increases with age. *Moniz (1994)* estimated that one in four women aged 60 and over will have an osteoporotic facture. About one third of all women aged 65 and over are afflicted with vertebral osteoprosis (*Sentipal et al. 1991*). Regular exercise and a healthy diet with enough calcium help teen and young adult women maintain good bone health and may reduce their high risk of osteoporosis later in life. Milk products, calcium fortified orange juice and soy beverages are main sources of calcium.

However, milk products are not 100% safe for human health for the reasons of lactose intolerance, high saturated fat content and possible increased risk of prostate cancer. Many people have some degree of lactose intolerance. For them, eating or drinking milk products causes problems such as cramping, bloating, and diarrhea. These symptoms can range from mild to severe. Certain groups are more likely to have lactose intolerance than others. According to the Harvard School of Public Health, 90% of Asians, 70% of blacks and Naive Americans, 50% of Hispanics are lactose intolerant; only 15% of Northern European descendents are lactose intolerant. Also, whole milk products are major source of saturated fat, which increases the risk for heart disease. A diet high in calcium has been implicated as a potential risk factor for prostate cancer and ovarian cancer. Other health concerns on milk consumption include that a daily intake over 2,000mg offers no added known benefits to bone health, and that food and supplement must not contain more phosphorus than calcium (*Harvard School of Public Health, 2003*).

Obesity is another serious health concern that is related to non-alcoholic beverage consumption. According to the 1996-1997 National Population Health Survey, 34% of Canadians aged 20 to 64 were overweight, and another 12%, approximately 2.1 million were obese. For children, the situation was even worse; 37% of children aged 2 to 11 were overweight, and 18% were obese (*Statistics Canada, National Longitudinal Survey of Children and Youth, 2000-2001*). Obesity increases the risk of some chronic diseases, such as high blood pressure, heart disease and diabetes (*Statistics Canada, National Population Health Survey, 1996-1997*). Lack of exercise and too much energy intake contribute to obesity. Soft drinks add non-nutritious calories to the diet and crowd out more nutritious diet choices, such as milk and fruit juices. The high sugar intake and calorie intake from the regular soft drinks consumption is likely to contribute to weight gain and obesity, which increases the risk of diabetes and cardiovascular disease. The phosphorus (often listed on the ingredient label of soda as phosphoric acid) contained in the soft drinks will also cause problems for human health. When the calcium to phosphorus ratio is lower than 1:2, the calcium can be taken from the bones in order to correct the ratio. This can lead to many of the problems of calcium deficiency, including osteoporosis. In general, the health concerns about soft drinks consumption include obesity, osteoporosis, tooth decay, heart disease and kidney stone.

Fruit and vegetable juices are considered good for human health, because they are rich in folate and vitamins. High intake of folate, vitamin B6 and fiber decreases the risk of high blood pressure, heart disease, stroke, and colon cancer. Orange juice and citrus fruit juice provide large amount of folate. Tomato products, including tomato juice, have carotenoids & lycopene, which may substantially reduce the risk of various cancers, including prostate cancer, pancreatic cancer, lung cancer, and colorectal cancer (*Giovannucci, 1999*).

3.5.2 Constructing Milk and Beverage Health Information Indicators

Sources of Health Information

Chern and Zuo (1995) summarized the sources of health information from USDA's 1987-88 Nationwide Food Consumption Survey (*NFCS*). The results showed that a household may obtain health information from several sources, such as health professionals, nutritionists, friends, radio and television, newspapers, governments and health organization publications, food company publications, and health claims on food packages. Among those sources, mass media is one of the most important ones. More than 47% of the survey respondents obtained health information from newspapers, magazines or books. These results support the methodology of generating consumer health information indices used in this study.

All the health information indicators used in food demand analysis are constructed based on counts of articles from either medicine journals or mass media newspapers and magazines. The implication of using counts of medicine journal articles is that an assumption has been made about the transmission from the medical articles to consumers, even though it is not reasonable to assume that consumers in general read scholarly medical journal articles to obtain health information. For example, *Brown and Schrader (1990)* used the MEDLINE database to identify the information source and constructed the health information index by explicitly making the assumption that medical practitioners pass on the information about cholesterol to patients. They do not refer to transmission of medical information to general consumers. In some health information studies, assumptions were made that consumers obtain their information from media sources, which is based on the medical research. For example, *Chern (2000)* found that the indicator constructed from Washington Post articles behave differently from the one constructed from Medline articles, but the estimation results from both the indices are virtually identical. However, *Houn et al. (1995)* found that newspapers and magazines present less information and a restrictive set of information as compared to what is available in the medical journals. These findings indicate that a health information indicator based on the Medline search may be a poor indicator of the amount of information that reaches the public.

Therefore, it is reasonable for this study to construct milk and other non-alcoholic beverage health information indices based on the articles published in the major newspapers and magazines across Canada. The information indexes can be obtained by using the publications library of *Factiva* (Previously *Dow Jones Interactive*) and *Canadian Newsstand*, and counting the number of articles, which contain the link between health information and milk and other non-alcoholic beverage consumption, by quarter and province for 1996 and 2001. Articles for the last quarter of 1995 and 2000 were also collected for the purpose of testing lagged effects of health information on beverage demand.

Article Searches

The search terms used for the searching in Dow Jones Interactive and Canada Newsstand are the following:

(i) Milk (dairy) and calcium, milk (dairy) and osteoporosis, milk (dairy) and lactose intolerance, milk (dairy) and cancer, and milk (dairy) and fat content;

(ii) Soft drinks and obesity, soft drinks and heart disease, soft drinks and cancer, soft drinks and kidney stones, soft drinks and osteoporosis, and soft drinks and tooth decay;

(iii) Orange juice and heart disease, orange juice and cancer, orange juice and folate, citrus fruit juice and cancer, citrus fruit juice and folate;

(iv) Vegetable/tomato juice and cancer, vegetable/tomato juice and heart disease.

By typing the above phrases, restricts the search within the major newspapers and magazines, the Dow Jones Interactive and Canada Newsstand search engines list both the abstract and the full text for all the articles that have the phrases of the search terms. The article abstracts and the full texts (not just the titles) are reviewed to further identify the unrelated articles that also contain the same phrases.

Positive and Negative Information

Commonly, "positive" information is defined as information that encourages consumption of related goods; while "negative" information is the information that discourages consumption. In previous studies, *Chern (2000)* used an total count (Positive + Negative) of all articles without disaggregating positive and negative information. Others (e.g. *Brown and Schrader, 1990*; *Kinnucan et al. 1997*; *Nivens and Schroeder, 2000*) used the net count information index (Negative – Positive), which take account of both the positive and negative information.

From the article searching and reviewing, 78% of the articles related to milk (dairy products) consumption are found to have positive health information for 1996, and 54% of the articles contain positive health information for milk and dairy products consumption in 2001. This shows that milk is a complex food, which has many controversies on its health benefits. The negative health information is also involved with animal welfare issues. On one hand, the positive milk health information will encourage people to choose milk products to help build and maintain healthy bones. On the other hand, the negative milk health information will drive consumers away from consuming milk for concerns over the negative health effects of its fat content.

For other beverage types, the direction provided by the health information is always consistent. The health information on soft drinks, fruit juice and vegetable juice gives consumers less confusion than the health information on milk does. In the case of soft drinks, most articles report that there is a link between soft drink consumption and health problems, such as obesity, diabetes, osteoporosis, and heart disease. Only one article reported positive health information, saying that soda pop is not bad for the bones. For fruit juices and vegetable juices, none of the articles report a link between juice consumption and health problems.

Thus, different methods are taken to construct health information indices for different types of beverages. For fluid milk, both the positive and negative health information indices are constructed based on the counts of the articles searched. The milk health information indices are expressed as:

(3.11) Positive Milk Health Information Index = # Positive $_{milk}$

(3.12) Negative Milk Health Information Index = # Negative $_{milk}$

For soft drinks, fruit juice and vegetable juice, it is more meaningful to apply the method of net count information index (*Brown and Schrader, 1990*) to construct the health information indices. Then the fruit juice health information index can be expressed as:

(3.13) Fruit Juice Health Information Index = (# Positive - # Negative) $_{fruit\ juice}$

Following the same rule, the tomato juice health information index can be expressed as:

(3.14) Vegetable Juice Health Information Index = (# Positive - # Negative) $_{tomato\ juice}$

Since soft drinks are reported to have a negative link with the health problems, the soft drinks health information index is constructed as:

(3.15) Soft Drinks Health Information Index = (# Negative - # Positive) $_{soft\ drinks}$

3.6 Demand Model Specification

In this section, the model specification for non-alcoholic beverage demand analysis will be discussed. The specified models include a general beverage demand model and a beverage demand model in a blockwise independent framework.

3.6.1 General Beverage Demand – A Complete *Lewbel (1989)* Model

The choice of functional form is an important consideration. Policy evaluations require reliable estimates of demand responsiveness to prices, information variables and other demographic variables. Different functional forms may generate different results and derive different policy implications. Previous studies have used either the Translog model (e.g. *Goddard, and Tielu, 1988*; *Goddard and Cozzarin, 1992*; *Goddard, Kinnucan, Tielu and Belleza, 1992*; *Gould, 1996*), the AIDS model (e.g. *Gould et al. 1990*; *Heien and Wessells, 1988, 1990*) or the Rotterdam model (e.g. *Brown and Lee, 1993, 1997*; *Gao and Lee, 1995*; *Xiao et al. 1998*). Choice of functional form was subjective in most of these non-alcoholic beverage studies. A flexible demand system proposed by *Lewbel (1989)* is selected for this study in order to generate reliable estimates.

In 1989, Lewbel proposed a flexible demand system that nests, as two special cases, the AIDS and Translog models. In particular, for a commodity bundle with n goods, prices $p = (p_1,\dots,p_n)'$, and total expenditure x, the indirect utility function $v(p,x)$ can be specified as:

$$(3.16)\quad \log[V(p,x)] = \sum_{i=1}^{n} b_i \log p_i + \log\left[d + \sum_{i=1}^{n} a_i \log p_i + 0.5\sum_{i=1}^{n}\sum_{j=1}^{n} c_{ij} \log p_i \log p_j - \left(\sum_{i=1}^{n} a_i + \sum_{i=1}^{n}\sum_{j=1}^{n} c_{ij} \log p_j\right)\log x\right].$$

By using Roy's identity, Lewbel's flexible demand system in expenditure share form can be derived as:

$$(3.17)\quad w_i = \left\{ a_i + \sum_{j=1}^{n} c_{ij} \log p_j + b_i \left(d + \sum_{j=1}^{n} a_j \log p_j + 0.5 \sum_{j=1}^{n} \sum_{k=1}^{n} c_{jk} \log p_j \log p_k \right) - \left[\sum_{j=1}^{n} c_{ij} + b_i \left(1 + \sum_{j=1}^{n} \sum_{k=1}^{n} c_{jk} \log p_k \right) \right] \log x \right\} \Big/ \left(1 + \sum_{j=1}^{n} \sum_{k=1}^{n} c_{jk} \log p_k \right),\ i = 1, \ldots, n,$$

where $\sum_{i=1}^{n} a_i = 1$, $\sum_{i=1}^{n} b_i = 0$, $\sum_{i=1}^{n} \sum_{j=1}^{n} c_{ij} = 0$, and $c_{ij} = c_{ji}$, for all i and j, are the restrictions of adding-up, homogeneity, and symmetry of the demand system respectively. Interesting properties of the demand system are that restrictions $b_i = 0$ for all i reduce the system to the Translog model, while restrictions $\sum_{j=1}^{n} c_{ij} = 0$ for all i reduce the system to the AIDS model. In empirical studies, the AIDS is often estimated through a simple linear approximation to avoid system nonlinearity. This approximation amounts to replacing

$$(3.18)\quad \left(d + \sum_{j=1}^{n} a_j \log p_j + 0.5 \sum_{j=1}^{n} \sum_{k=1}^{n} c_{ij} \log p_j \log p_k \right)$$

with a mechanical price index, such as the Stone price index (*Deaton and Muellbauer, 1980*).

Advertising, health information, and demographic variables can be incorporated into the demand system by specifying the parameters, a_i, as functions of these variables M_h:

$$(3.19)\quad a_i = \alpha_{i0} + \sum_h \alpha_{ih} M_h,$$

in which case the adding-up restriction requires that $\sum_i \alpha_{i0} = 1$, and $\sum_i \alpha_{ih} = 0$ for all h. Thus the full Lewbel demand model with advertising, health information and demographic variables in expenditure share forms is expressed as:

(3.20)

$$w_i = \left\{ \left(\alpha_{i0} + \sum \gamma_i \log(A_{it}) + \sum \eta_i \log(H_{it}) + \sum \theta_i \log(D_{it})\right) + \sum_{j=1}^{n} c_{ij} \log p_j + b_i \left(d + \sum_{j=1}^{n} a_j \log p_j + 0.5 \sum_{j=1}^{n} \sum_{k=1}^{n} c_{jk} \log p_j \log p_k \right) \right.$$

$$\left. - \left[\sum_{j=1}^{n} c_{ij} + b_i \left(1 + \sum_{j=1}^{n} \sum_{k=1}^{n} c_{jk} \log p_k \right) \right] \log x \right\} \Big/ \left(1 + \sum_{j=1}^{n} \sum_{k=1}^{n} c_{jk} \log p_k \right) \qquad i, j = 1, \ldots, n$$

Therefore, a two-stage Lewbel model will be estimated to examine beverage demand in Canada. The second stage includes five equations, including milk, fruit juice, vegetable juice, soft drinks, and coffee and tea. The last equation is dropped from the estimation to avoid the singularity problem.

3.6.2 Beverage Demand in a Blockwise Dependent Framework

To capture the demand characters for detailed items in the five major beverage categories, particularly different milk types, a blockwise dependent AIDS model of beverage demand is constructed following *Yang and Koo (1994)*. The first stage of the demand system is a double log model with the total expenditure as the dependent variable, and prices, income, seasonality, advertising expenditures and health information indices as independent variables.

The second stage is composed of seven simultaneously estimated beverage share equations. To avoid the singularity problem, the last equation of coffee and tea is dropped in the estimation procedure. The milk expenditure share equation in the general demand model is separated into three share equations of more disaggregated milk types. These detailed milk types are whole milk, 2% milk and other milk (including 1%, skim and specialty milk). In these equations, the expenditure shares of the beverage types are the dependent variables, and the independent variables include prices, income, advertising, and health information variables. The share equation can be written as:

$$
(3.21) \quad \begin{aligned} w_{ih} &= a_{ih} + \sum_j d_{ij}(D_{ij}) + \sum_j \gamma_{ij} \ln(A_{ij}) + \sum_j \eta_{ij} \ln(H_{ij}) \\ &+ \sum_k c_{ihk} \ln(p_{ik}) + \sum_{j \neq i} c_{ihj} \ln(p_j) + b_{ih} \ln(E/P) \end{aligned}
$$

where $\ln(p_j) = \sum_k w_{jk} \ln(p_{jk})$. w_{ih} is the expenditure share of the individual beverage product. For fluid milk products, w_{ih} is the expenditure share of the disaggregated milk product such as whole milk, 2% milk and other milk. a_{ih} is an intercept term. d_{ij} is the coefficient of the demographic variable, γ_{ij} is the coefficient of the advertising variable, η_{ij} is the coefficient of the health information index, c_{ihk} is the price coefficient of the detailed milk product, c_{ihj} is the price coefficient of other beverage types other than milk, and b_{ij} is the total expenditure coefficient. P is the expenditure share weighted stone price index. In the blockwise dependent AIDS model context, the price index is written as $\ln(P) = \sum_i \sum_h w_{ih} \ln(p_{ih})$.

The demand restrictions of adding-up, homogeneity, and symmetry for the blockwise dependent AIDS model are:

(3.22) $\sum_i \sum_h a_{ih} = 1$; $\sum_h c_{ihk} = 0$; $\sum_i \sum_h c_{ihj} = 0$; $\sum_i \sum_h b_{ih} = 0$; (Adding-up)

(3.22) $\sum_k c_{ihk} + \sum_{j \neq i} c_{ihj} = 0$; (Homogeneity)

(3.23) $c_{ihk} = c_{ikh}$ (Symmetry)

To test whether the model specification in the blockwise dependent structure is appropriate, a product aggregation test will be conducted. The hypothesis of this test is:

the three types of milk products can be aggregated. It is identical to testing the restrictions that the parameters in the blockwise dependent AIDS model are the same as the parameters in a normal AIDS model with a general milk product. For the purpose of this test, the restrictions imposed on the blockwise dependent AIDS model are:

(3.24) $a_{ih} = a_i$, $\quad c_{ihjk} = c_{ij}$, $\quad$ and $b_{ih} = b_i$.

A chi-square test will be conducted for this test. The conclusion of an appropriate model specification will be made, when the chi-square statistics are significant and the hypothesis is rejected.

3.6.3 Calculation of Elasticities

From the coefficient estimates, a number of demand elasticities can be calculated to measure the change of quantity demanded in response to the change in independent variables, such as total expenditure, prices, advertising expenditures, health information indices, with all other variables held constant (*Goddard et al. 1992*).

The general form of expenditure elasticities at the second stage is derived as:

(3.25) $$q_i = \frac{w_i * TEXP}{p_i}$$

$$\Rightarrow \frac{\partial q_i}{\partial TEXP} = \frac{\partial w_i}{\partial TEXP}\frac{TEXP}{p_i}$$

$$\Rightarrow \frac{\partial q_i}{\partial TEXP}\frac{TEXP}{q_i} = \frac{\partial w_i}{\partial TEXP}\frac{TEXP}{w_i}.$$

On the other hand, the general form of expenditure elasticities across both stages is derived as:

$$(3.26)\quad q_i = \frac{w_i * TEXP}{p_i}$$

$$\Rightarrow \frac{\partial q_i}{\partial TEXP} = \frac{\partial w_i}{\partial TEXP}\frac{TEXP}{p_i} + \frac{\partial TEXP}{\partial TEXP}\frac{w_i}{p_i}$$

$$\Rightarrow \frac{\partial q_i}{\partial TEXP}\frac{TEXP}{q_i} = \frac{\partial w_i}{\partial TEXP}\frac{TEXP}{w_i} + 1.$$

In the case of prices, the price elasticities can be derived from the share equations. The general form of own- and cross-price elasticities of demand at the second stage is derived as:

$$(3.27)\quad q_i = \frac{w_i * TEXP}{p_j}$$

$$\Rightarrow \frac{\partial q_i}{\partial p_j} = \frac{\partial w_i}{\partial p_j}\frac{TEXP}{p_i}$$

$$\Rightarrow \frac{\partial q_i}{\partial p_j}\frac{p_j}{q_i} = \frac{\partial w_i}{\partial p_j}\frac{p_j}{w_i} - \delta,\ \delta = 1 \text{ for } i = j \text{ and } \delta = 0 \text{ for } i \neq j.$$

The general form for own- and cross-price elasticities of demand across both stages is derived as:

$$(3.28)\quad q_i = \frac{w_i * TEXP}{p_j}$$

$$\Rightarrow \frac{\partial q_i}{\partial p_j} = \frac{\partial w_i}{\partial p_j}\frac{TEXP}{p_i} + \frac{w_i}{p_j}\frac{\partial TEXP}{\partial p_j} - \frac{w_i TEXP}{p_i^2}$$

$$\Rightarrow \frac{\partial q_i}{\partial p_j}\frac{p_j}{q_i} = \frac{\partial w_i}{\partial p_j}\frac{p_j}{w_i} + \left(\frac{\partial w_i}{\partial TEXP}\frac{TEXP}{w_i} + 1\right)\frac{\partial TEXP}{\partial p_j}\frac{p_j}{TEXP} - \delta.$$

$\delta = 1$ for $i = j$ and $\delta = 0$ for $i \neq j$.

Following the same derivation process, one can give the general form of advertising and health information elasticities of demand both at the second stage and across two stages. The informational variable elasticities at the second stage are expressed as:

$$(3.29)\quad \frac{\partial q_i}{\partial \theta_j}\frac{\theta_j}{q_i} = \frac{\partial w_i}{\partial \theta_j}\frac{\theta_j}{w_i},$$

and the informational variable elasticities across both stages are expressed as:

$$(3.30)\quad \frac{\partial q_i}{\partial \theta_j}\frac{\theta_j}{q_i} = \frac{\partial w_i}{\partial \theta_j}\frac{\theta_j}{w_i} + \left(\frac{\partial w_i}{\partial TEXP}\frac{TEXP}{w_i} + 1\right)\frac{\partial TEXP}{\partial p_j}\frac{p_j}{TEXP},$$

where θ = advertising expenditures or health information indices.

3.7 Summary

The theoretical and empirical frameworks that are used for completing this study is developed in this chapter. The estimation results and policy implications will be discussed in the following two chapters respectively.

Chapter 4 The Data

4.1 Canadian Family Food Expenditure Survey Data

4.1.1 General Information

Data used in this thesis are compiled from the Family Food Expenditure Survey (FFES) conducted by Statistics Canada. The Family Food Expenditure Survey provides information on food expenditures, income, and other characteristics of families and individuals living in private households in Canada.

Statistics Canada has carried out seventeen food expenditure surveys since 1953. Most of the early surveys (1955, 1957, 1962, 1972, 1974, 1976, 1884, and 1990) were carried out in selected cities. The surveys conducted in 1969, 1978, 1982, 1986, 1992, 1996 and 2001 have included both urban and rural areas. The urban surveys are carried out in selected metropolitan areas. For the national survey, families and individuals surveyed are those living in private households in the 10 provinces, as well as Whitehorse, Yellowknife (1992, 1996, and 2001) and Iqualuit (2001). The surveys have excluded persons living on First Nation Reserve, families of official representatives of foreign countries living in Canada, members of religious and other communal colonies, and persons living full time in institutions (e.g. inmates of penal institutions or chronic care patients living in hospitals and nursing homes).

The Food Expenditure Survey is a periodic survey carried out every 4 or 5 years. It is designed to supplement the Survey of Household Spending (SHS) by providing a level of expenditure detailed on food commodities not feasible in the context of the SHS methodology. The primary reason for collecting food expenditure data is to monitor and periodically update the weights used in the computation of the Consumer Price Index

(CPI). In addition, food expenditure data classified by variables such as income, household type and province, provide the basis for a variety of analytical investigations of the food purchasing habits of households in Canada, such as market analysis and nutritional studies.

4.1.2 The Sample and Data Collection

The survey sample was a stratified, multi-stage sample selected from the Labor Force Survey (LFS) sampling frame. Sample selection is comprised of two main steps: the selection of clusters (small geographic areas) from the LFS frame and the selection of dwellings within these selected clusters. A detailed description of the Labor Force Survey sampling frame can be found in Methodology of the Canadian Labor Force Survey (*Statistics Canada, 1998*).

The sample was drawn for the whole year and then divided into monthly sub-samples making an evenly distributed data collection over the entire 2001 calendar year. This ensures that we get an accurate picture of food expenditures regardless of the season.

The Food Expenditure Survey was conducted monthly during the survey calendar year. Data were collected by an interviewer through a personal interview using a paper questionnaire, and two weekly diaries were also left for the respondent to complete daily for two consecutive weeks.

The questionnaire was primarily used to collect selected socio-economic characteristics, as well as information on the household's purchasing habits and food expenditures if away from home during the previous month. Following the interview, respondents were asked to maintain a daily record of all food expenditures (excluding those while on a trip overnight or longer) using two one-week diaries. Respondents were asked to provide detailed descriptions of daily food purchases including type of packaging (frozen, canned, dried, other), number of units purchased, weight or volume per unit in either metric or imperial measure, the total cost of the purchase and whether purchased from a food specialty store, convenience store, supermarket or others. In 2001, respondents were asked to attach their grocery store receipts to the diaries so that the processing staff could identify certain food commodities or find unreported weights.

For meals and snacks in restaurants, the type of meal (breakfast, lunch, dinner, between-meals food) was requested. Respondents were also asked to record the number of meals and total cost, and to indicate whether the meal had been purchased from a table-service restaurant, fast-food restaurant, cafeteria or other type of restaurant.

At the end of each one-week recording period interviewers were required to return to the respondent's home to pick up and review the previous week's diary for completeness and accuracy.

4.1.3 Data Structure – Household Summary File and Detailed Food Category File

The FFES data consist of two files, the summary household file and the detailed food category file. The summary household file contains the data on demographic and socioeconomic variables, food-away-from-home information, and aggregated data concerning detailed food-at-home expenditures.

The summary household file arranges the socioeconomic and demographic variables into several general categories, which include:

1) Household identification and location: the identification and location variables enable users to identify the geographic location and the time of the survey. This category of variables includes identification number, week, quarter, weight, region, and size of area of residence code.

2) Characteristics of reference person: the household reference person is the member of the household listed on the questionnaire who is mainly responsible for his/her financial maintenance (e.g. pays the rent, mortgage, property taxes, and electricity). When all members of the household share equally in financial maintenance, any member may be designated the reference person. This category of variables includes marital status, age, and gender of the reference person.

3) Characteristics of spouse of reference person: this category identifies the demographic and socioeconomic characteristics of the spouse of the household reference person, such as age, gender etc.

4) Household description: this category of variables includes household type (one person household, couple without children, couple with never-married children, couple with additional persons, lone-parent household, other household-all persons related and other household-at least one person unrelated), household size, number of seniors 65 years or more, number of adults 25 to 64 years, number of youths 15 to 24 years, number of children under 15 years, number of economic families in household and income group code.

The detailed item file, records the detailed food items purchased and consumed at home. The purchase of an item by a household in a week in one type of store constitutes one record. If a household made no purchases of an item, no record will be present for that item, which represents the zero expenditure problem described earlier. The variables in this file include identification number, diary week, food item code, type of store purchase made, quantity purchased, and expenditure.

4.1.4 Non-Alcoholic Beverage Items in the FFES Data

The FFES data records the quantities consumed and expenditures of 19 individual beverage items, which compose several types of non-alcoholic beverages, including fluid milk, fruit juice, vegetable juice, soft drinks and coffee and tea (Chapter Three, Section 3.2). Other non-alcoholic beverages recorded in the FFES data are rice drinks and soya bean milk, which are categorized into the dairy product substitutes. Dairy product substitutes also include cream substitutes, milk substitutes, whipped cream substitutes, coffee rich (TM), coffee-mate(TM), cool whip(TM), dream whip and Nutrifil (TM). Since rice drink and soya bean milk can not be separated from other non-beverage dairy product substitutes, they are not included in this study.

In order to obtain information on household expenditures and quantities of the three categories of beverages specified in this study, the data files require manipulation through the following steps:

1) It is necessary to identify and aggregate various beverage items in each main food category for each household to obtain the gross expenditure in the five or seven categories. For each detailed food item, the FFES data assign an item code that can be easily recognized by any database software. This item code is the key variable used in the aggregating process.

2) After obtaining the gross quantity and expenditures for the five categories for each household, we need to connect this newly generated data with the summary files of socioeconomic and demographic variables. The bridge for these two files is the identification number of each household in both files.

By doing the above two steps, a data file with both demographic variables and aggregated food consumption information on five or seven main categories is developed for further estimation purposes.

4.2 Summary Statistics for the FFES Data

The 1996 and 2001 samples from the FFES data are used in this study. The changes in the beverage expenditure and the consumer socioeconomic and demographic status over the six year period are described in this section.

4.2.1 Statistics of Socioeconomic and Demographic Variables

The household socioeconomic and demographic variables, including survey time, survey region, characteristics for the reference person, and household description, from the 1996 and 2001 samples are summarized in Table 4.1.

For both the 1996 and 2001 samples, survey respondents are distributed evenly into the four quarters in a year. The distribution of the survey area has changed slightly from the 1996 to the 2001 sample. In the 1996 sample, 22.62% of the survey respondents are from the Atlantic Provinces and 15.68% are from Quebec; while in the 2001 sample, 12.07% of the reference persons are from Atlantic Provinces and 22.08% are from Quebec.

Table4.1 Statistics of demographic variables from FFES data, 1996 and 2001.

	1996		2001	
Household characteristics	Frequency	Percentage	Frequency	Percentage
Survey time				
First quarter	2687	24.60	1461	25.89
Second quarter	2789	25.53	1318	23.36
Third quarter	2728	24.97	1372	24.31
Fourth quarter	2720	24.90	1492	26.44
Living region				
Atlantic provinces	2471	22.62	681	12.07
Quebec	1713	15.68	1246	22.08
Ontario	2789	25.53	1605	28.44
Prairie	2541	23.26	1215	21.53
British Columbia	1384	12.67	896	15.88
Other	26	0.24		
Marital status				
Married or common law	6898	63.15	3592	63.65
Never married (single)	1564	14.32	817	14.48
Other (seperated, divorced or widowed)	2462	22.54	1234	21.87
Gender				
Male	5220	47.78	2351	41.66
Female	5704	52.22	3292	58.34
Urban/rural area				
Urban (30,000 or greater)	7404	67.78	4050	71.77
Urban (under 30,000)	1137	10.41	679	12.03
Rural	1521	13.92	914	16.20
Other	862	7.89		
Household type				
One person household	2512	23.00	1296	22.97
Couple without children	2717	24.87	1524	27.01
Couple with never-married children	3802	34.80	1868	33.10
Couple with additional persons (may include children)	379	3.47	200	3.54
Lone-parent household	847	7.75	399	7.07
Other household-all persons related	354	3.24	186	3.30
Other household-at least one person unrelated	313	2.87	170	3.01
Total household size				
1 person household	2512	23.00	1296	22.97
2 person household	3520	32.22	1944	34.45
3 person household	1830	16.75	918	16.27
4 person household	1979	18.12	980	17.37
5 person household	779	7.13	358	6.34
6 person or more household	304	2.78	147	2.60
Number of family members				
number of seniors (65 or older)				
0	8465	77.49	4363	77.32
1	1637	14.99	839	14.87
2 or more	822	7.52	441	7.81
number of aldults (25 to 64)				
0	2120	19.41	1081	19.16

	1	2827	25.88	1471	26.07
	2 or more	5977	54.71	3091	54.78
number of youths (15 to 24)					
	0	8245	75.48	4275	75.76
	1	1681	15.39	893	15.82
	2 or more	998	9.14	475	8.42
number of children (14 or under)					
	0	7383	67.59	3902	69.15
	1	1543	14.12	802	14.21
	2 or more	1998	18.29	939	16.64
Number of economic families					
	1	10532	96.41	5444	96.47
	2 or more	392	3.59	199	3.53
		Mean	**S.D.**	**Mean**	**S.D.**
Age of reference person		47.56	15.84	48.44	15.54
Total household size		2.63	1.35	2.57	1.32
Income		43233	35898	48352	28148

Data source: Statistics Canada, Family Food Expenditure Survey, 1996 and 2001.

As to respondents' socio-demographic and household description variables, a similar distribution is presented in the statistics from both samples. The socio-demographic variables include marital status, age, urban/rural residence and income. For marital status, 63% of the respondents are married or in a common law, 14% have never married, and about 21% have other marital status, such as separated, divorced or widowed. For gender of the reference persons, 41% (2001) to 47% (1996) are male, while 52% (1996) to 58% (2001) are female. Around 5% of the respondents fall into the age category of under 24, 77% are between 25 to 65 years age, and 18% are 66 years age or older. As for the living area, 68% (1996) as compared to 72% (2001) of the respondents are from urban areas with a population greater than 30,000, 10% (1996) compared to 16% (2001) are from urban areas with a population less than 30, 000, and another 14% (1996) compared to 16% (2001) are from rural areas.

Household income before tax includes income from all sources, such as salaries, self-employment, investment income, government transfer payments, and other sources, for all household members during the preceding 12 months. The presentation of household income in the 1996 sample is different from the one in the 2001 sample. In 1996, the actual value of household income was recorded for the respondent. In 2001, income was grouped into 12 level groups, ranged from less than $10,000 to $100,000 or more, with one group of "not stated". In order to compare income variables for both samples, it is necessary to adjust income level codes in 2001 data into a series of values of income. The transformation can be completed by taking the median value of each income range to represent the same income code group.

Household description variables include household type, household size, number of family members and number of economic families. As listed in Table 4.1, a couple with never-married children, couple without children, and one person households are the three major household types, which compose 33% (2001) - 35% (1996), 25% (1996) - 27% (2001), and 23% of the total survey samples respectively. For total household size, 2 person households is the largest category, which covers 32% (1996) to 34% (2001) of the survey samples, followed by 1 person households (23% for both samples), 4 person households (17% in 2001 compared to 18% in 1996) and 3 person households (about 16% for both samples). The statistics of number of family members are consistent with the ones of marital status and household types. The majority of the respondents (55% for both samples) have 2 or more adults in the household, about 24% of the survey households have 1 or more youths from 15 to 24 years old, about 30% (2001) to 32% (1996) have 1 or more children who is 14 or under 14 years old, and 22% have 1 or more seniors (65 or older).

During the estimation process, variables are selected from those listed in Table 4.1, and are incorporated into the demand functions as demand shifters. Age and income are treated as continuous variables; while most of the demographic variables, including seasonality, region and household composition, are treated as dummy variables.

4.2.2 Summary Statistics for Non-Alcoholic Beverage Consumption

In this section, average quantities of the five general and 19 detailed beverage types are calculated; summary statistics of all types of beverage consumption are presented in Table 4.3. With the exception of specialty milk, apple juice, concentrated orange juice, other coffee and tea, which represent a small proportion of the total beverage expenditure (Table 3.1 and 3.2), the average quantity purchased per household for the major types of beverages have increased for the period 1996 – 2001.

Compared to using time series disappearance data, using micro level household data may provide clearer insights for consumer beverage demand in Canada. The data provided in Table 4.2 show that, with the exception of skim milk and coffee, the per capita consumption of types of beverages retrieved from CANSIM disappearance data are higher than the per capita consumption calculated from the FFES data. This is due to the fact that the disappearance data include not only household purchases but also the consumption by the industrial manufacturers and the foodservices sector. In contrast, the per capita consumption calculated from FFES data is specifically associated with daily household use of the products. Therefore, using FFES data may be better suited than using CANSIM disappearance data in describing consumers' purchase decisions on beverages in response to health information and advertising campaigns.

Table 4.2 Comparison of per capita consumption for beverage products (litres) from FFES estimated data and CANSIM Data.

	1996		2001	
	CANSIM Data	FFES Data	CANSIM Data	FFES Data
1% milk	15.43	15.12	17.16	17.06
Standard milk	15.37	12.13	13.99	10.45
2% milk	46.99	39.99	41.68	34.11
Skim milk	7.74	8.37	8.7	9.58
Apple juice	6.97	6.42	6.84	4.75
Orange juice	13.58	7.36	14.09	9.37
Soft drinks	110.65	70.26	113.24	78.84
Coffee (kg)	4.64	2.42	4.94	2.21
Tea (kg)	0.62	1.01	0.93	0.67

Data source: Compiled from CANSIM Per Capita Consumption Data and the Family Food Expenditure Survey, 1996 and 2001 (Statistics Canada).

The percentage of zero expenditures for different beverage types can be calculated by deviding the number of non-consuming households to the number of households of the whole sample (Table 4.3). Milk in total has the least percentage of zero expenditures. Fruit juice and soft drinks have a similar percentage at around 40%. The frequency of zero expenditures for vegetable juice products is the highest among all the major beverage types.

4.2.3 Product Prices

The calculation of the prices for beverage products, and the missing prices associated with the non-consuming households will be discussed in this section.

Prices for the five or seven beverage categories are not provided by the FFES data and must be derived from the existing variables. First, the unit values of detailed beverage items within each beverage category are obtained by dividing expenditures by their corresponding quantities (*Deaton, 1988*). Then the price for each food category is calculated as an expenditure share weighted average of unit values. The aggregated prices for different beverage groups are specified as:

$$p_{ag} = \sum_{i=1}^{s} w_{is} u_{is}$$

where p_{ag} is the vector of aggregated prices for different beverage categories, u_{is} is the unit value for detailed beverage items, and w_{is} is the expenditure share of the *i*th item of a particular beverage category.

The estimated average prices of p_{ag} will be used to represent the missing prices for the non-purchasing households. The descriptive statistics of the unit prices are presented in Table 4.4.

Table 4.3 Descriptive statistics of beverage consumption in Canada, 1996 and 2001.

Beverage	Quantity consumed (litres/two weeks)	1996 Mean	1996 S.D.	2001 Mean	2001 S.D.
1% milk	Whole sample (2001=5643; 1996=10924)	1.16	2.93	1.73	4.50
	Consuming households (2001=24.4%; 1996=23.1%)	5.03	4.19	7.10	6.70
whole milk	Whole sample (2001=5643; 1996=10924)	0.93	2.65	1.09	3.68
	Consuming households (2001=17%; 1996=19.4%)	4.82	4.18	6.42	6.75
2% milk	Whole sample (2001=5643; 1996=10924)	3.08	4.25	3.30	5.82
	Consuming households (2001=47%; 1996=57.3%)	5.37	4.38	7.02	6.77
skim milk	Whole sample (2001=5643; 1996=10924)	0.64	2.06	0.88	3.08
	Consuming households (2001=14.6%; 1996=15.3%)	4.20	3.58	6.05	5.82
specialty milk	Whole sample (2001=5643; 1996=10924)	0.06	0.58	0.06	0.54
	Consuming households (2001=1.8%; 1996=2.1%)	2.83	2.85	3.13	2.52
Milk	**Whole sample (2001=5643; 1996=10924)**	**5.88**	**5.77**	**7.06**	**8.13**
	Consuming households (2001=81.1%; 1996=86.2%)	**6.82**	**5.68**	**8.71**	**8.19**
apple juice	Whole sample (2001=5643; 1996=10924)	0.49	1.61	0.49	1.71
	Consuming households (2001=14.4%; 1996=16.3%)	3.02	2.85	3.42	3.20
grapefruit juice	Whole sample (2001=5643; 1996=10924)	0.07	0.55	0.09	0.59
	Consuming households (2001=3.1%; 1996=2.9%)	2.47	2.16	2.72	1.98
orange juice	Whole sample (2001=5643; 1996=10924)	0.57	1.48	0.81	1.99
	Consuming households (2001=23.6%; 1996=21.7%)	2.61	2.19	3.43	2.79
other fruit juice	Whole sample (2001=5643; 1996=10924)	0.65	1.82	1.29	2.87
	Consuming households (2001=32.9%; 1996=23.9%)	2.74	2.85	3.91	3.85
concentrated orange juice	Whole sample (2001=5643; 1996=10924)	0.21	0.67	0.15	0.64
	Consuming households (2001=9.3%; 1996=16%)	1.34	1.16	1.57	1.49
concentrated other juice	Whole sample (2001=5643; 1996=10924)	0.16	0.69	0.23	1.15
	Consuming households (2001=11.3%; 1996=10.1%)	1.58	1.57	2.06	2.80
Fruit juice	**Whole sample (2001=5643; 1996=10924)**	**2.16**	**3.44**	**3.05**	**4.47**
	Consuming households (2001=59.9%; 1996=56.6%)	**3.81**	**3.82**	**5.09**	**4.79**
carbonated beverages	Whole sample (2001=5643; 1996=10924)	4.28	6.68	5.20	9.23

	Consuming households (2001=49.8%, 1996=56.3%)	7.60	7.34	10.44	10.78
fruit drinks	Whole sample (2001=5643; 1996=10924)	0.49	1.49	0.51	1.64
	Consuming households (2001=17.1%, 1996=20.2%)	2.43	2.50	2.98	2.90
other non-alcoholic beverages	Whole sample (2001=5643; 1996=10924)	0.64	3.28	1.80	7.16
	Consuming households (2001=19.4%, 1996=12.4%)	5.12	7.97	9.26	13.97
Soft drinks	**Whole sample (2001=5643; 1996=10924)**	**5.40**	**7.84**	**7.60**	**12.27**
	Consuming households (2001=13.7%; 1996=65%)	**8.32**	**8.39**	**12.20**	**13.69**
tomato juice	Whole sample (2001=5643; 1996=10924)	0.13	0.69	0.14	0.84
	Consuming households (2001=6.3%; 1996=6.7%)	1.99	1.83	2.23	2.54
other canned vegetable juice	Whole sample (2001=5643; 1996=10924)	0.16	0.81	0.21	0.97
	Consuming households (2001=8.4%; 1996=7.9%)	2.06	2.07	2.56	2.28
Vegetable juice	**Whole sample (2001=5643; 1996=10924)**	**0.30**	**1.11**	**0.36**	**1.29**
	Consuming households (2001=61.5%; 1996=13.4%)	**2.20**	**2.25**	**2.60**	**2.50**
roasted or ground coffee	Whole sample (2001=5643; 1996=10924)	0.09	0.31	0.11	0.40
	Consuming households (2001=13.5%; 1996=12.7%)	0.70	0.57	0.80	0.80
other coffee	Whole sample (2001=5643; 1996=10924)	0.10	0.32	0.08	0.31
	Consuming households (2001=14.4%; 1996=18%)	0.55	0.56	0.54	0.63
tea	Whole sample (2001=5643; 1996=10924)	0.08	0.28	0.06	0.23
	Consuming households (2001=13.8%; 1996=15.7%)	0.50	0.53	0.43	0.48
Coffee and tea	**Whole sample (2001=5643; 1996=10924)**	**0.26**	**0.62**	**0.25**	**0.56**
	Consuming households (2001=35.7%; 1996=38.6%)	**0.68**	**0.65**	**0.69**	**0.76**

Data source: Compiled from the Family Food Expenditure Survey, 1996 and 2001 (Statistics Canada).

Table 4.4 Descriptive statistics of the prices for the consuming households for 1996 and 2001 ($/litre).

	1996			2001		
	Consuming households	Mean	Standard deviation	Consuming households	Mean	Standard Deviation
Whole milk	2115	0.53	0.30	960	0.71	0.35
[redacted]						
Other milk	3960	0.82	0.30	2100	0.99	0.31
[redacted]						
Fruit juice	6183	1.11	0.59	3382	1.00	0.50
[redacted]						
Vegetable juice	956	1.01	1.00	547	1.21	1.50
[redacted]						

Data source: Statistics Canada, Family Food Expenditure Survey, 2001.
* $/kg for coffee and tea.

4.3 Advertising Expenditure Data

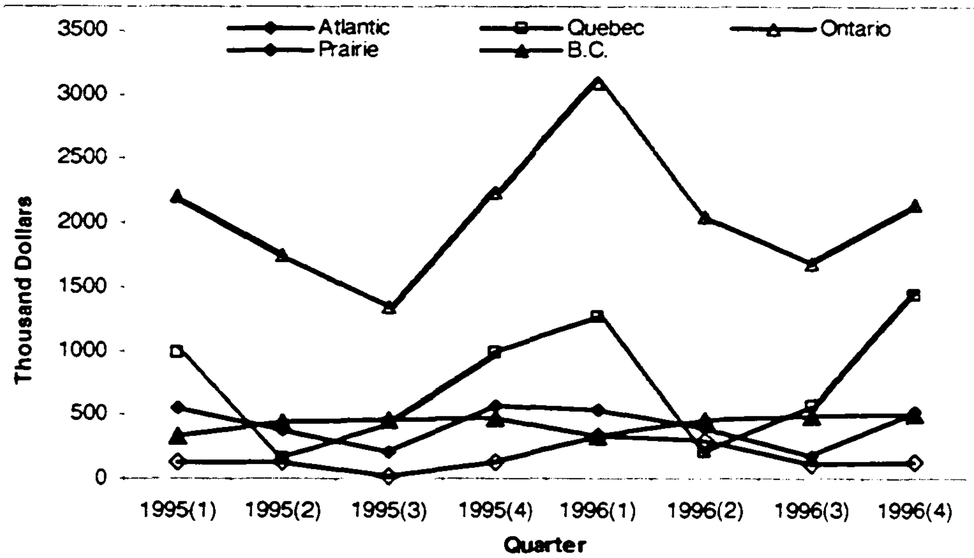
The advertising expenditure data, including fluid milk generic advertising and brand advertising will be discussed in this section.

Advertising has been a common marketing strategy used by the dairy industry and other beverage industries to keep and expand their market shares. Advertising expenditures include generic advertising expenditures and brand advertising expenditures. In Canada, generic fluid milk advertising is specifically done by the provincial level milk boards to promote fluid milk consumption in general. While fluid milk processing companies (including private companies and producer owned co-operatives) and beverage companies spend their own advertising budgets on promoting products with different brands. To match the 1996 and the 2001 FFES samples used in this study, generic and brand milk advertising expenditures are applied for the time periods from 1995 to 1996 and from 2000 to 2001. The additional periods (1995 adn 2000) of advertising data are needed for testing advertising lag and cumulative effects.

There is a large body of literature suggesting that both current and lagged advertising expenditures affect consumers' consumption choices in the current period (*Liu et al. 1990*; *Suzuki et al. 1994*). In empirical estimation it is common to test different lag/cumulative lengths and to select the final lag/cumulative specification based on previous studies and overall goodness of fit (*Lenz et al. 1998*).

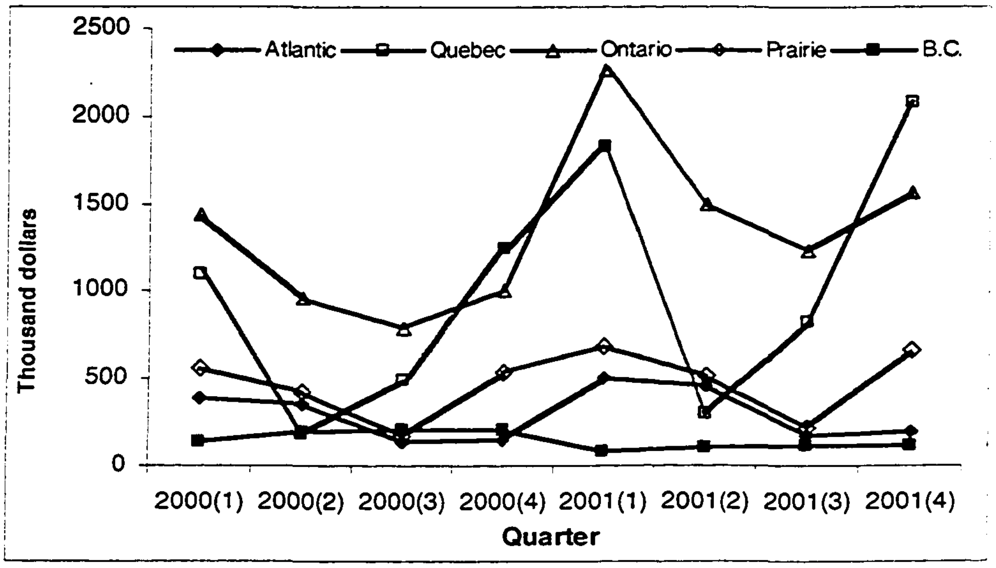
Milk generic advertising data are corroborated from the annual reports of the provincial dairy commodity boards. The advertising budget in each region is allocated in four quarters, which gives enough data variation to make the cross sectional estimation possible. Levels of milk generic advertising expenditures for the five geographic regions in the periods of 1995/1996 and 2000/2001 are illustrated in Figure 4.1 and Figure 4.2. The annual total generic milk advertising expenditures for the five regions did not change much during the 7 year period from 1995 to 2001. For both time periods, the largest spender of generic advertising money was Ontario, followed by Quebec, the prairies, Atlantic provinces, and British Columbia.

Figure 4.1 Levels of fluid milk generic advertising expenditures 1995/1996.



Source: Estimated with articles collected from *Factiva* and *Canadian Newsstand*.

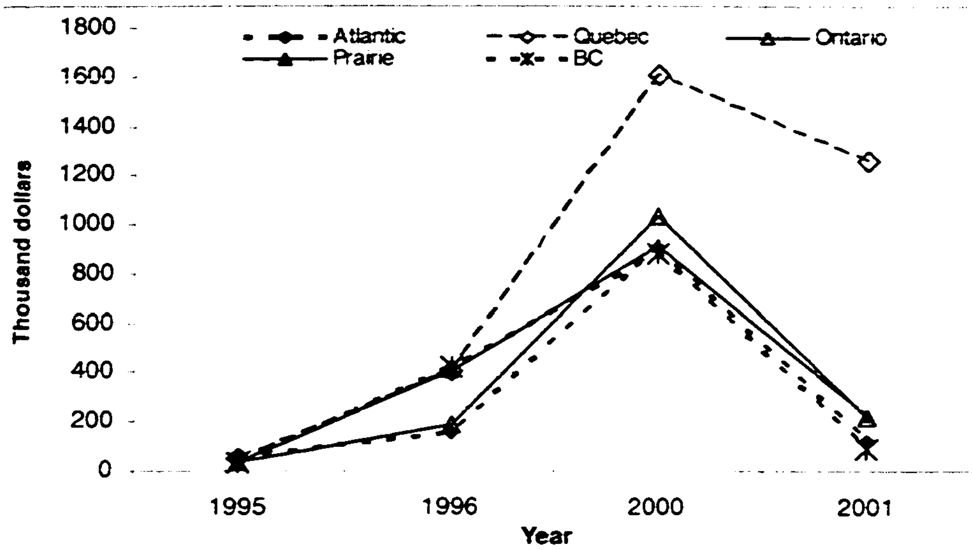
Figure 4.2 Levels of fluid milk generic advertising expenditures 2000/2001.



Data source: Estimated with articles collected from *Factiva* and *Canadian Newsstand.*

Branded milk advertising expenditure data are estimated from media advertising by ACNielsen, and the data are categorized by the advertising company. As only annual numbers are provided by ACNielsen, the quarterly advertising expenditures are estimated through dividing the annual data by four. Relative to the real quarterly expenditure of generic advertising, the estimated quarterly expenditure is less ideal in the view of econometrics estimation. However, the annual ACNielsen estimated brand advertising is the best data obtained for this study. The advertising companies have their target regions in marketing products. For example, *Natrel* is a Quebec based dairy company; most of its fluid milk products are sold in Quebec. Thus, the brand advertising expenditures are distributed into different regions according to the business radiant of the companies. Illustrated in figure 4.3, the annual expenditures of branded milk advertising are not stable and do not show a clear pattern. Quebec is the largest spender out of the five regions, and the Atlantic region has the smallest share.

Figure 4.3 Levels of brand milk advertising expenditures, 1995/1996 and 2000/2001.



Data source: Estimated with articles collected from *Factiva* and *Canadian Newsstand.*

4.4 Health Information Indices

Several health information indices are used in the empirical estimation; summary statistics on these health information indices will be presented in this section.

Consumers receive health information from many sources including physicians, neighbors, and the public press. The underlying is that consumers' attitudes toward non-alcoholic beverages change slowly as scientific information accumulates. Thus, a health information index (could be from current period, cumulated one period, or lagged one period) based on numbers of articles in the public media serves as a proxy for health information reaching consumers from many sources.

These media indices were obtained by using the publications library of *Factiva* (previously *Dow Jones*) and *Canadian Newsstand* and taking into account the number of articles published in Canada by quarter and province/region for 1996 and 2001. 44 newspapers are reviewed, 11 of them being national. The articles from the 11 national newspapers will be used in all provinces. The Health Information Indices are counts of the number of articles related to health concerns and health benefits of fluid milk, fruit juices, soft drinks, and vegetable juices.

Fluid milk consumption has both positive and negative effects on consumers' health. The positive effect is related to the fact that milk is a main source of various nutrients, such as calcium which helps prevent osteoporosis; the negative effect is related to the lactose intolerance, high saturated fat content, ovarian cancer and prostate cancer. Positive and negative milk health information indices are structured for the four quarters of 1996 and 2001 (Figure 4.4-4.7). It is noticeable that the number of negative milk health information related articles increased significantly in the fourth quarter of 2001. Most of those articles are reports related to "milk sucks" campaigns launched by PETA[4] in Canada at the end of 2001. Thus, both positive and negative milk health information indices will be incorporated into the demand analysis for 1996 and 2001.

Consumption of soft drinks is perceived to have negative impacts on consumers' nutrition intake. Some articles reported that soft drinks crowd out more nutritious drink choices. People become increasingly concerned about health consequences of consuming soft drinks. This is demonstrated in the increase of the number of articles that reported the link between soft drinks and human health from 1996 to 2001 (Figure 4.8 and 4.9).

All the fruit juice and vegetable juice health information encourages people to consume more fruit juice and vegetable juice by presenting positive health effects of consuming them. Similar to the soft drinks health information indices, the total number of articles related to fruit juice and vegetable juice health information increased over the

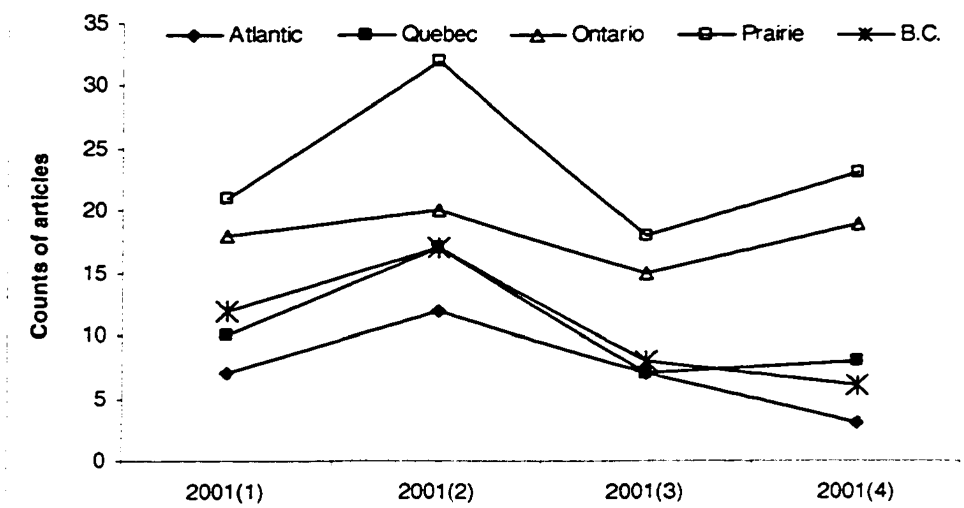
[4] PETA stands for "People for the Ethical Treatment of Animals", which is the largest animal rights organization in the world (www.peta2.com).

period from 1996 to 2001. This also reflects that people have become more and more health conscious about what they eat and what they drink.

4.5 Summary

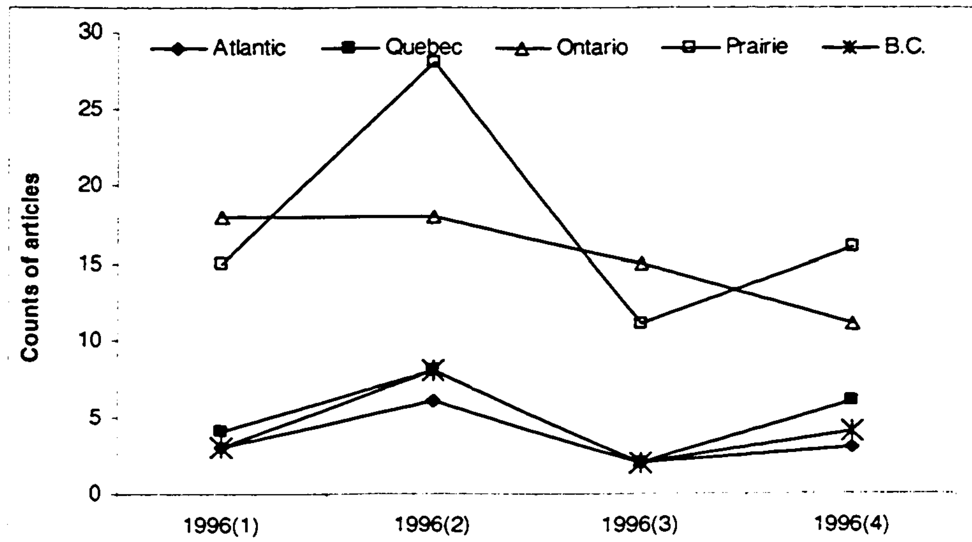
In summary, descriptive statistics of the data that are used in this thesis were presented in Chapter Four. The data include beverage expenditure data and household demographics data from the Canadian Family Food Expenditure Survey (1996 and 2001), milk advertising expenditure data and beverage health information indices. The Canadian household demand estimation for non-alcoholic beverages is carried out by using these data. The estimation results will be discussed in the next chapter, followed by the summary and implication chapter.

Figure 4.4 Positive milk health information index, 2001.



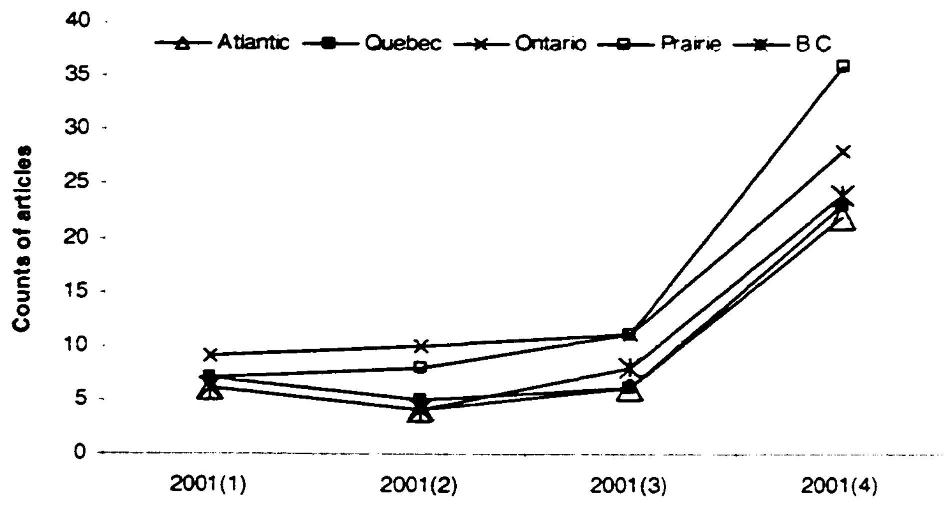
Data source: Estimated with articles collected from *Factiva* and *Canadian Newsstand.*

Figure 4.5 Positive milk health information index, 1996.



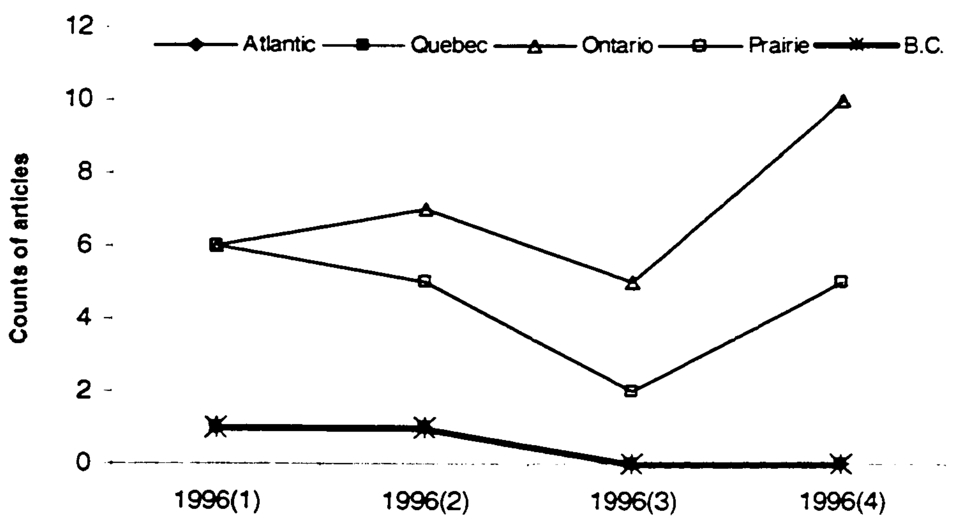
Data source: Estimated with articles collected from *Factiva* and *Canadian Newsstand.*

Figure 4.6 Negative milk health information index, 2001.



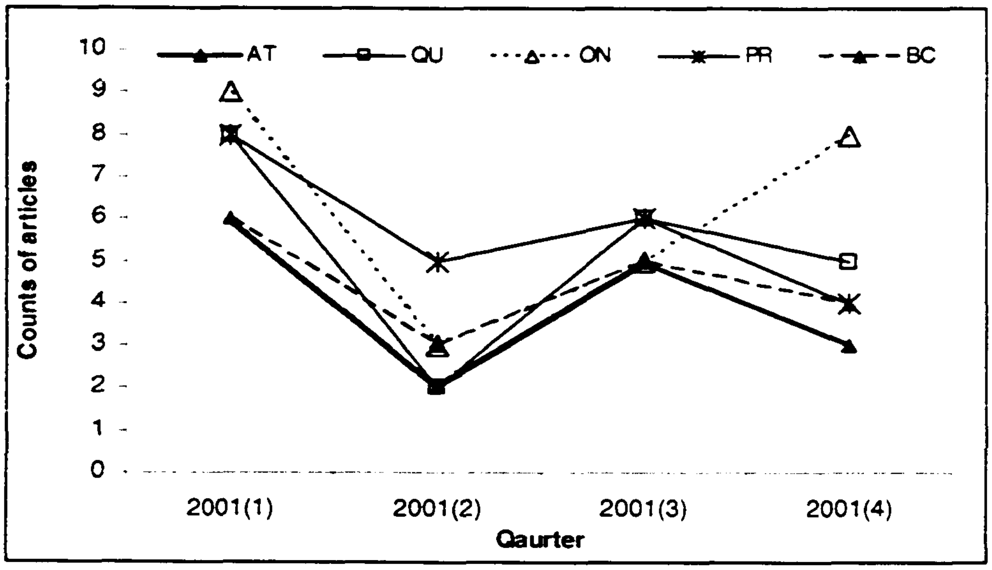
Data source: Estimated with articles collected from *Factiva* and *Canadian Newsstand*.

Figure 4.7 Negative milk health information index, 1996.



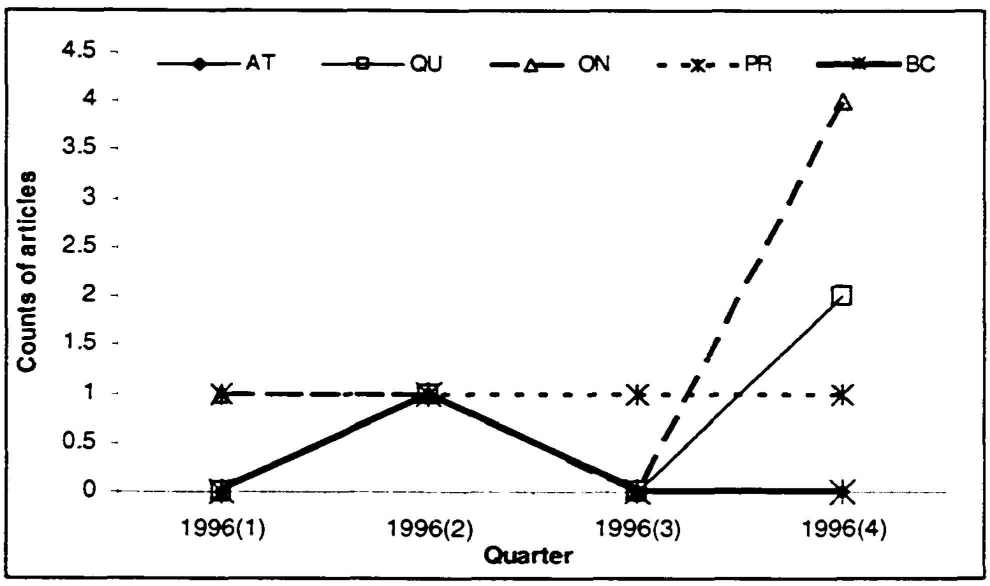
Data source: Estimated with articles collected from *Factiva* and *Canadian Newsstand*.

Figure 4.8 Soft drinks health information index, 2001.



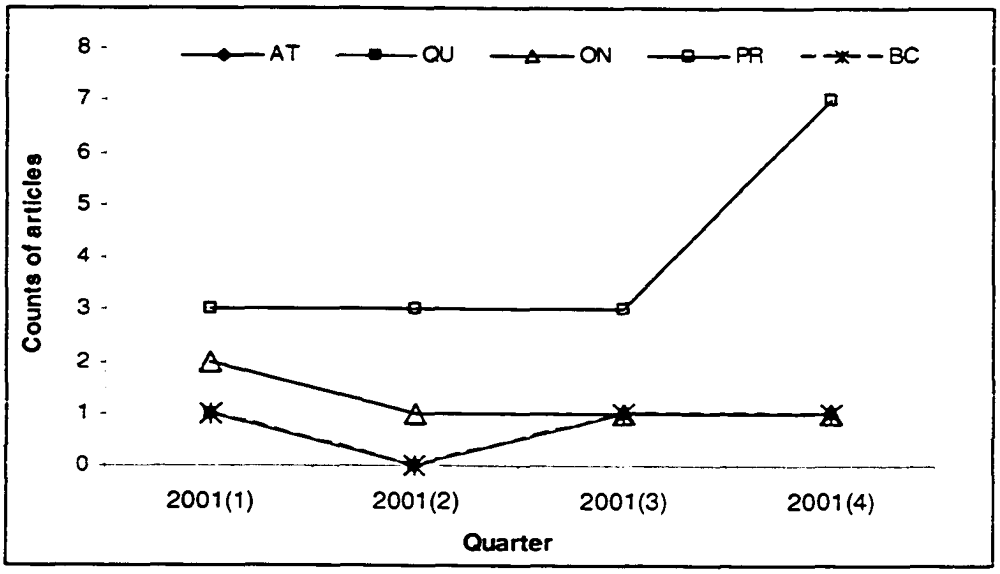
Data source: Estimated with articles collected from *Factiva* and *Canadian Newsstand.*

Figure 4.9 Soft drinks health information index, 1996.



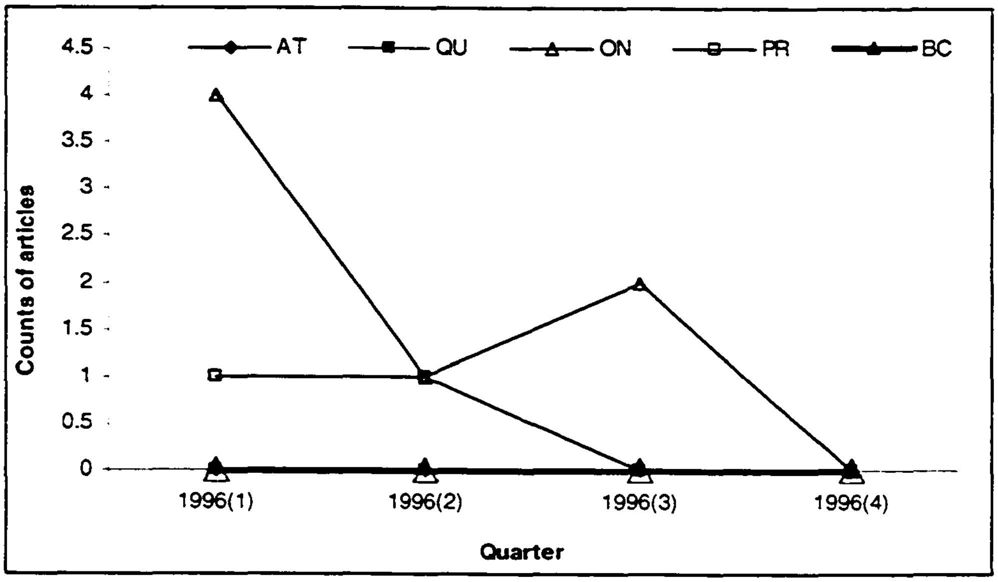
Data source: Estimated with articles collected from *Factiva* and *Canadian Newsstand.*

Figure 4.10 Fruit juice health information index, 2001.



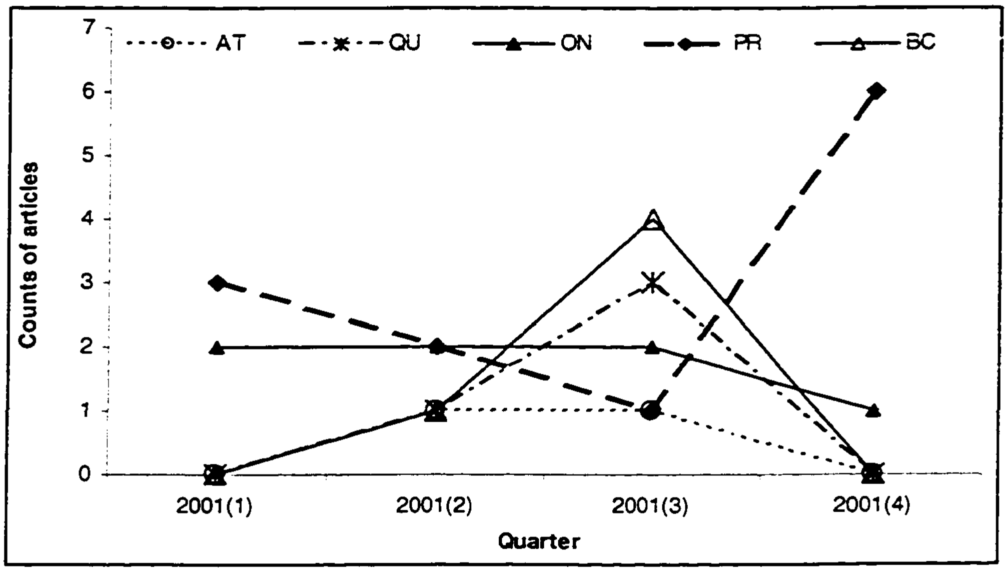
Data source: Estimated with articles collected from *Factiva* and *Canadian Newsstand.*

Figure 4.11 Fruit juice health information index, 1996.



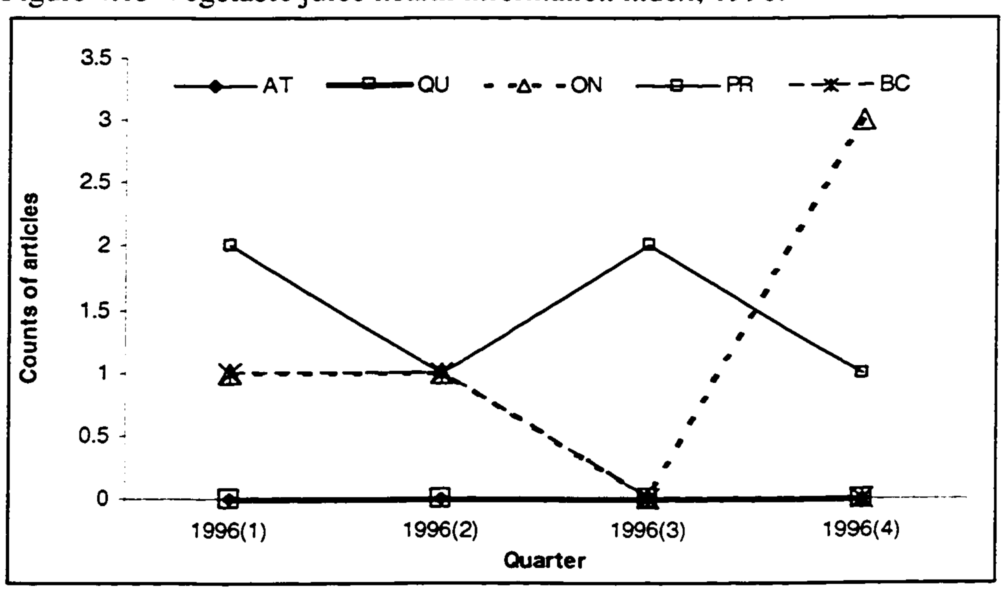
Data source: Estimated with articles collected from *Factiva* and *Canadian Newsstand.*

Figure 4.12 Vegetable juice health information index, 2001.



Data source: Estimated with articles collected from *Factiva* and *Canadian Newsstand.*

Figure 4.13 Vegetable juice health information index, 1996.



Data source: Estimated with articles collected from *Factiva* and *Canadian Newsstand.*

Chapter 5 Estimation Results

In previous chapters, study objectives were defined, related literature was reviewed, a study framework was structured, and the data were described. The estimation results for both the 1996 and 2001 samples will be reported in this chapter. This chpater is composed of three sections. Household demand for beverages estimated in a general form of a flexible demand system (Lewbel model) will be discussed in the first section. In the second section, household demand for beverages in a blockwise dependent structure with the product aggregation test will be reported. The third section is the summary. The results of estimation and tests are presented in Table 5.1 to Table 5.72.

5.1 General Household Demand for Non-Alcoholic Beverages in Canada

The results from the estimation of the general Canadian household beverage demand model for both the 1996 and 2001 samples are reported in this section, including price effects, health information effects, advertising effects, and impacts from household demographic variables. To illustrate demand effects from different demographics, elasticities are calculated by regions, by income groups, and by family structures. The results are also compared with the ones from previous fluid milk and beverage demand studies.

5.1.1 Estimation Procedure

The two stage complete flexible demand system (*Lewbel, 1989*) is estimated to describe the Canadian household demand for non-alcoholic beverages using TSP 4.5. In the first stage, a double log model is specified with the total expenditure as a function of selected variables, including the expenditure share weighted average price, informational variables, and demographic variables. The second stage is composed of the simultaneously estimated expenditure share equations of the five major beverage types, milk, fruit juice, vegetable juice, soft drinks, and coffee and tea. The last expenditure share equation (coffee and tea) is dropped from the estimation to avoid the singularity of the covariance matrix. In each of the equations, the expenditure share of the product is specified as a function of own-price, cross-prices, informational variables and demographic variables. Restrictions including adding-up, homogeneity and symmetry are imposed in the Lewbel estimation.

Before further estimation is undertaken, two different sets of restrictions are tested to decide the final specification of the complete Lewbel model: the test for including the informational variables and demographic variables, and the test for deciding appropriate periods (e.g. current, lagged one period or cumulated one period) for the informational variables. The restrictions are nested in the global model, and a likelihood ratio test procedure is employed to conduct the tests. The hypotheses are various informational variables and demographic variables are not arguments of the complete demand system. The log likelihood ratio test statistic is given as: $LR = -2(L_{ristricted} - L_{unristricted})$, where $L_{ristricted}$ is the maximum value of the likelihood function for the model subject to the restriction or restrictions, and $L_{unristricted}$ is the maximum value of the likelihood function for the model without the restriction or restrictions. Under the null hypothesis, the test statistic is asymptotically distributed as chi-square with degrees of freedom equal to the number of restrictions to be tested (*Green, 2003*). The calculated chi-square statistics are compared with the 5% critical chi-square value for the corresponding degrees of freedom. The unrestricted model is the base model, which only includes the beverage price index at the first stage, and own- and cross-prices and price index at the second stage.

The tested informational variables and demographic variables are added to the base model one at a time. The informational variables include positive milk health information, negative milk health information, fruit juice health information, vegetable juice health information, soft drink health information, generic milk advertising, and brand milk advertising. The demographic variables include region, age, gender, family structure, income, and urbanity. The order of the tested variables and test statistics are given in Table 5.1 and Table 5.2. Three specifications, including current period, lagged one period, and cumulated one period, are tested for each of the informational variables. The specification with the highest log likelihood ratio is selected for the next step test and the final model specification. Most of the hypotheses that the variable does not contribute to explanatory power of the model are individually and jointly rejected at the 5% significance level, with the exception of the regional dummy variables for both the 1996 sample and 2001 samples. Hence the complete demand system will be estimated with the inclusion of all the health informational variables, milk advertising variables and most of the demographic variables except for regional dummies. Specifications of the informational variables with the highest LR ratio are different for 1996 and 2001. However for the purpose of comparison and consistency, the 2001 specification is adopted for both samples. Thus, the final specifications for the informational variables are: one period lagged positive milk health information index, negative milk health information index, fruit juice health information index, soft drinks health information index, and generic milk advertising; current period vegetable juice health information index; and cumulated one period brand milk advertising.

Elasticities for prices and informational variables are calculated as a measurement of the demand effects. All the elasticities are calculated across two stages with the mean values of the related variables in the model. Elasticities are not only calculated for the whole samples, but also calculated for sub-samples, such as the five geographic regions, three groups with low, medium and high income levels, and households with children and other family structures. Elasticities calculated for different sub-samples are to catch changes of consumer purchase decisions due to changes of their demographic characteristics. Both coefficient estimates and elasticity calculated across both stages will be included in the result discussions in the following sections. The estimation results from the general beverage demand model are presented in Table 5.3 to Table 5.37 (see Appendix A).

Table 5.1 Nested model tests for informational variables, demographics and seasonality as an argument of the general beverage demand model, 2001.

Order	Null hypothesis	Likelihood value	Number of parameters	Degree of freedom	LR ratio	χ^2 (5%)
1	Base Model (unrestricted)	621.015	25	--		
2	Positive milk health information (current period)	627.379	30	5	12.73	11.07
	Positive milk health information (cumulate 1 period)	626.003	30	5	9.98	11.07
	Positive milk health information (lag 1 period)	642.582 *	30	5	43.13	11.07
3	Negative milk health information (current period)	643.297	35	10	44.56	18.31
	Negative milk health information (cumulate 1 period)	643.001	35	10	43.97	18.31
	Negative milk health information (lag 1 period)	647.919*	35	10	53.81	18.31
4	Fruit juice health information (current period)	651.056	40	15	60.08	25
	Fruit juice health information (cumulate 1 period)	652.116	40	15	62.2	25
	Fruit juice health information (lag 1 period)	656.088*	40	15	70.15	25
5	Vegetable juice health information (current period)	663.853*	45	20	85.68	31.41
	Vegetable juice health information (cumulate 1 period)	659.426	45	20	76.82	31.41
	Vegetable juice health information (lag 1 period)	657.827	45	20	73.62	31.41
6	Soft drinks health information (current period)	665.45	50	25	88.87	37.65
	Soft drinks health information (cumulate 1 period)	666.67	50	25	91.31	37.65
	Soft drinks health information (lag 1 period)	668.364*	50	25	94.7	37.65
7	Milk generic advertising (current period)	672.77	55	30	103.51	43.77
	Milk generic advertising (cumulate 1 period)	678.736	55	30	115.44	43.77
	Milk generic advertising (lag 1 period)	679.771*	55	30	117.51	43.77
8	Milk brand advertising (current period)	699.847	60	35	157.66	49.8
	Milk brand advertising (cumulate 1 period)	701.369*	60	35	160.71	49.8
	Milk brand advertising (lag 1 period)	700.825	60	35	159.62	49.8

Table 5.1 Nested model tests for informational variables, demographics and seasonality as an argument of the general beverage demand model, 2001 (continuation).

Order	Null hypothesis	Likelihood value	Number of parameters	Degree of freedom	LR ratio	χ^2 (5%)
Demographics						
9	Region (4 regions at both the 1st and 2nd stage)	-9053.08 (At least one coefficient in the table above could not be estimated due to singularity of the data or derivatives. Regional dummies were deleted from the test estimation.)				
	Region (4 regions at the 2nd stage)	-9053.08 (At least one coefficient in the table above could not be estimated due to singularity of the data or derivatives. Regional dummies were deleted from the test estimation.)				
10	Age	817.873	65	40	393.72	55.76
11	Gender	830.639	70	45	419.25	61.66
12	Family structure (Couple with children)	1142.73	75	50	1043.43	67.51
13	Income	1257.88	80	55	1273.73	73.31
14	Urbanity	1302.24	85	60	1362.45	79.08

Note:

1. * Functional form that is selected for the next step test and the final estimation.
2. Data source: Family Food Expenditure Survey, 2001 (Statistics Canada).

Table 5.2 Nested model tests for informational variables, demographics and seasonality as an argument of the general beverage demand model, 1996.

Order	Null hypothesis	Likelihood value	Number of parameters	Degree of freedom	LR ratio	χ^2 (5%)
1	Base Model (unrestricted)	4464.19	25	--		
2	Positive milk health information (current period)	4495.61	30	5	62.84	11.07
	Positive milk health information (cumulate 1 period)	4497.20	30	5	66.02	11.07
	Positive milk health information (lag 1 period)	4496.10	30	5	63.82	11.07
3	Negative milk health information (current period)	4522.11	35	10	115.84	18.31
	Negative milk health information (cumulate 1 period)	4521.50	35	10	114.62	18.31
	Negative milk health information (lag 1 period)	4501.64	35	10	74.90	18.31
4	Fruit juice health information (current period)	4504.90	40	15	81.42	25
	Fruit juice health information (cumulate 1 period)	4516.17	40	15	103.96	25
	Fruit juice health information (lag 1 period)	4510.12	40	15	91.86	25
5	Vegetable juice health information (current period)	4520.15	45	20	111.92	31.41
	Vegetable juice health information (cumulate 1 period)	4522.71	45	20	117.04	31.41
	Vegetable juice health information (lag 1 period)	4521.05	45	20	113.72	31.41
6	Soft drinks health information (current period)	4548.23	50	25	168.08	37.65
	Soft drinks health information (cumulate 1 period)	4533.18	50	25	137.98	37.65
	Soft drinks health information (lag 1 period)	4532.15	50	25	135.92	37.65
7	Milk generic advertising (current period)	4568.38	55	30	208.38	43.77
	Milk generic advertising (cumulate 1 period)	4610.09	55	30	291.80	43.77
	Milk generic advertising (lag 1 period)	4610.03	55	30	291.68	43.77
8	Milk brand advertising (current period)	4618.05	60	35	307.72	49.8
	Milk brand advertising (cumulate 1 period)	4621.13	60	35	313.88	49.8
	Milk brand advertising (lag 1 period)	4623.25	60	35	318.12	49.8

Table 5.1 Nested model tests for informational variables, demographics and seasonality as an argument of the general beverage demand model, 1996 (continuation).

Order	Null hypothesis	Likelihood value	Number of parameters	Degree of freedom	LR ratio	χ^2 (5%)
Demographics						
9	Region (4 regions at both the 1st and 2nd stage)	- 14896.7 (At least one coefficient in the table above could not be estimated due to singularity of the data or derivatives. Regional dummies were deleted from the test estimation.)				
	Region (4 regions at the 2nd stage)	- 14896.7 (At least one coefficient in the table above could not be estimated due to singularity of the data or derivatives. Regional dummies were deleted from the test estimation.)				
10	Age	4907.17	65	40	885.96	55.76
11	Gender	4936.63	70	45	944.88	61.66
12	Family structure (Couple with children)	5566.32	75	50	2204.26	67.51
13	Income	5657.42	80	55	2386.46	73.31
14	Urbanity	5673.27	85	60	2418.16	79.08

Note:

1. * Functional form that is selected for the next step test and the final estimation.
2. Data source: Family Food Expenditure Survey, 1996 (Statistics Canada).

5.1.2 Price Effects

Most of the price coefficients and all of the own-price elasticites have the expected signs and are statistically significant at the 5% level. Households with different demographic characteristics respond differently to changes in prices.

The expenditure share weighted average price index is included in the first stage double log model estimation. The coefficients for the price index are statistically significant and negative for both the 1996 and 2001 samples. This result suggests that when the average beverage price increases, the total expenditure on beverage consumption will decrease. At the second stage estimation, individual prices are included in the estimation and the elasticity calculation. All the own-price coefficient estimates and elasticities have the right signs and are statistically significant for 1996 and 2001. Most of the cross-price coefficients have the expected positive signs and are statistically significant at the 5% level (Table 5.3).

The price elasticity is a function of the estimated price coefficients. The price elasticities calculated across both stages of the demand system are defined as unconditional uncompensated price elasticities, which take into account effects from the total expenditure. Price elasticities illustrate the relationships between prices and consumption more precisely than the price coefficients do. All the uncompensated own-price elasticities are statistically significant at the 5% level and have the expected negative signs for both the 1996 and 2001 samples, showing that the five major types of beverage are normal goods and the demand will fall following an increase in their prices (Table 5.5). The results of own-price elasticities are consistent with most of the previous non-alcoholic beverage demand studies (*Goddard and Tielu, 1988; Xiao et al. 1998*).

Milk, fruit juice, soft drinks, and coffee and tea have price elasticities smaller than -1, indicating these products are price-elastic. Among the five beverage types, milk own-price elasticity has the largest magnitude, suggesting milk is the most price elastic. Most of the previous studies suggested that non-alcoholic beverage demand is price inelastic (*Goddard and Tielu, 1988; Xiao et al. 1998*). The difference may be caused by the different natures between time series data and cross-sectional data. The magnitudes of the price effects for the five major non-alcoholic beverages are very similar between the 1996 and 2001.

The uncompensated cross-price elasticities show interesting relationships between the five categories of beverages. Except for cross-price elasticities of fruit juice – vegetable juice, milk – vegetable juice, and soft drinks – vegetable juice, most cross-price elasticities are statistically significant at the 5% level, and have the unexpected negative sign. This suggests that there are no substitution relationships between different beverage types, and that they are gross complimentarity. These results are consistent with the ones presented in *Goddard and Tielu (1988)*, while most of other previous studies suggest net substitution between different types of beverages (*Xiao et al., 1998*). A comparison of own-price elasticities for fluid milk is presented in the following table (Table 5.1.1).

Table 5.1.1 Comparison of fluid milk own-price elasticities.

Study	Price elasticity
Xiao et al. (1998)	-0.1922
Reynolds (1991)	-0.0177
Chung and Kaiser (2000)	-0.4878
Goddard and Cozzarin (1992)	-0.97
Goddard and Tielu (1988)	-0.224
Kinnucan (1987)	-0.730
Chung and Kaiser (2000)	0.0096
This study (2001)	-1.106
This study (1996)	-1.129

The regional price elasticities calculated by the five geographic regions and three household income levels show similar consumer responses to price changes as the price elasticities calculated with the whole sample. This is true for both the 1996 and 2001 sample.

Own-price elasticities calculated by family structures are all statistically significant at the 5% level, and have the expected negative signs. With both 1996 and 2001, the magnitude of most of the own-price elasticity is larger for "couple with children" than for other household types (except for vegetable juice own-price elasticity in the 1996 sample). This result indicates that households of "couple with children" are more price sensitive for the five categories of beverages than other types of households are. This may be due to the fact that they tend to purchase more beverages than other types of households (also see section 5.1.5).

5.1.3 Health Information Effects

This section will be focused on impacts of various types of beverage health information on beverage demand. The health information indices incorporated in this study include a positive milk health information index, a negative milk health information index, a fruit juice health information index, a vegetable juice health information index, and a soft drinks health information index (Table 5.6).

Positive Milk Health Information

From both the coefficient and the elasticity estimates, positive milk health information is only statistically significant at the 20% level, but the impacts varied from

1996 to 2001. For the milk equation, the positive milk health information elasticity has an expected positive sign for the 1996 sample, this indicate that consumers are likely to purchase more milk, when they are exposed to information related to the health benefits of consuming milk. However, the own milk health information elasticity has a negative sign for the 2001 sample. This result indicates that positive milk health information may decrease people's total milk consumption in 2001.

The obvious contradictory results may be due to the changes of the context of the positive health information from 1996 to 2001. The total number of articles that contain positive milk health information has increased significantly from 1996 to 2001. Most of those articles published in 2001 promote the health benefits particularly for skimmed milk and partly skimmed milk. This type of information may not strengthen consumers' confidence in the health benefits of milk in general. By contrast, consumers might question the health effects with regards to the fat content in milk. When consumers receive this kind of information, they may evaluate the possible negative health effects associated with the fat content higher than the positive benefits of the milk products, and begin to reduce their total milk consumption. This argument could be validated by *Chung and Kaiser* (*2000*), in which a fat concern variable was included in the New York City fluid milk demand study. The fat concern variable is constructed based on the percentage of consumers expressing concern regarding an attitudinal question "... a person should be cautious about the fat in one's diet" in a national wide survey conducted by the National Panel Diary Group in the U.S. Their results demonstrate that as consumers' concerns on dietary fat grew, milk consumption will decrease.

The cross positive milk health information elasticity for fruit juice is statistically significant at the 5% level, and has a negative sign with the 2001 sample. This indicates that positive milk health information may have a negative impact on the demand for fruit juice. Positive milk health information has no significant influence on vegetable juice and coffee and tea consumption, and does not decrease consumer demand for soft drinks.

Previous health information effectiveness studies have been done on demand for egg, fats and oils, and meats, while very few are done on examining impacts of health information on fluid milk demand. Therefore, the comparison of results is limited to one previous study by *Chern* (*2003*) (Table 5.1.2).

Table 5.1.2 Comparison of health information effects for fluid milk.

Study	Health information elasticity
Chern (2003)	0.118 [1]
This study (1996 sample)	0.017 [2]
This study (2001 sample)	-0.026 [2]

Note: [1] Milk health information = the amount of positive health information related articles – the amount of negative health information related articles.
[2] Positive milk health information.

Milk positive health information elasticities calculated by geographic regions are similar to the elasticity estimates from the total sample. The magnitude of responses to the positive health information is similar for consumers from different regions as well.

The magnitude of the own positive milk health information elasticities calculated by household income levels goes up with the increase of household income (both 1996 and 2001). The more total income a household has, the more likely it will take actions to adjust their milk consumption when receiving positive milk health information.

Elasticities calculated by family structures show that the magnitude of the own positive milk health information elasticity is higher for "couple with children" than that for other types of households. This implies that "couple with children" respond more actively to the positive milk health information. Because people are paying more attention to the health and safety status of their children, households with children are more health conscious than other types of households.

Negative Milk Health Information

From the estimation results of both coefficients and elasticities, negative milk health information has different effects for 1996 and 2001. With the 1996 sample, both the coefficient estimate and the elasticity at the milk equation are statistically significant only at the 20% level, and have negative signs. The coefficient estimates and the elasticity estimates are statistically significant at the soft drinks equation (5% level) and coffee and tea equation (10% level), and have positive signs. This suggests that the negative milk health information does hurt consumers' confidence in milk consumption, and decreases the demand for milk in general. When consumers received the negative health information for milk, they may decrease their milk consumption and turn to other beverages, such as soft drinks and coffee and tea.

However, with the 2001 sample, both the coefficient estimates and the elasticity estimates are not statistically significant for all the beverage types, indicating the negative milk health information has no influence on consumer demand for the five major beverage categories. During the search for health information articles related to milk consumption, PETA and the "vegan"[5] are identified as the two major sources opposing milk information. PETA launched "*milk sucks*" campaign in Canada at the end of 2001, while "vegans" advocate their extreme vegetarian diet excluding any form of foods from animal. Results from this study show that their campaigns opposing milk are not effective and do not have negative impacts on milk demand. As no previous studies construct a negative milk health information index, the negative health information elasticity comparison is not available.

Negative milk health information elasticities calculated by regions are similar to those calculated with the whole samples. The results do not show a significant difference in the magnitudes of the elasticities between the five major geographic regions.

Elasticities calculated by income levels are similar to those calculated with the whole samples. For the 1996 sample, the influence of the negative health information in decreasing milk demand becomes stronger with the increase of the household income. Households with higher income level respond more actively to the negative milk health information.

Elasticites calculated by family structures show that "couple with children" have higher magnitude of the own milk negative health information elasticity than other types of households. This indicates that households with children are more likely to decrease their milk consumption than other types of households when receiving negative milk health information (1996 sample).

[5] Vegan stands for veganism, an extreme type of vegetarianism. People who are vegans do not eat animal products, including meat, seafood, eggs and diary products.

Fruit Juice Health Information

From both the coefficient estimates and the elasticity estimates, the fruit juice health information is statistically significant at the 5% level and has a positive sign at the fruit juice equation, and has a negative sign at the milk equation and the coffee and tea equation (2001). This clearly shows that the positive fruit juice health information significantly increases the demand for fruit juice. In the mean time, the information tends to lower people's consumption for milk and coffee and tea. However, the estimation results from the 1996 sample do not show a clear pattern of the impacts of fruit juice health information on fruit juice and other beverages.

Fruit juice health information elasticities calculated by geographic regions, different income levels and family structures have similar results and magnitudes with the elasticities calculated by the whole samples.

Vegetable Juice Health Information

The coefficient and elasticity estimates show different impacts of the vegetable juice health information on beverage demand between 1996 and 2001. For the 1996 sample, the vegetable juice cross milk and fruit juice health information coefficient estimate and elasticity estimate are statistically significant at the 5% level and the 10% level respectively, but have positive signs. The vegetable juice cross soft drinks health information coefficient estimate and elasticity estimate are statistically significant at the 15% level, and has the expected negative sign. For the 2001 sample, vegetable juice cross fruit juice health information coefficient estimate and elasticity estimate are statistically significant at the 10% level, and have positive signs. These results indicate that the vegetable health information may positively influence the consumption for healthy beverages, such as milk and fruit juice.

Vegetable juice health information elasticities calculated by geographic regions, different income levels and family structures have similar results and magnitudes as the elasticities calculated by the whole sample.

Soft Drinks Health Information

The results for the soft drinks health information varied from 1996 to 2001. For the 2001 sample, the own soft drinks health information coefficient estimate and elasticity estimate are statistically significant (15% significance level) and have negative signs. This indicates that the soft drinks health information is effective in reducing people's consumption of soft drinks. The non-significant soft drinks cross other beverage health information coefficients and elasticities imply that consumers do not necessarily switch their consumption to other beverages. For the 1996 sample, soft drinks health information does not have significant effects on all types of beverage consumption.

Elasticities calculated by different regions and household income levels are similar to each other for both 1996 and 2001.

The magnitude of the own soft drinks health information elasticities for households with children are lower than those for other types of households (1996 and 2001). This indicates that soft drinks is another important beverage type consumed in households of "couple with children", and that parents are less responsive to negative soft drinks health information than other household types.

5.1.4 Advertising Effects

Impacts of advertising variables, which include both generic milk advertising and brand milk advertising, on consumers' non-alcoholic beverage purchasing decisions will be discussed in this section. Both the advertising coefficients and elasticities are discussed (Table 5.7). Advertising elasticities are also calculated by regions, household income levels and family structures to capture the effectiveness on consumer demand with respect to different demographic groups.

Generic Milk Advertising

For generic milk advertising, both the own- coefficient and elasticity estimate are statistically significant at the 5% level and have positive signs. This shows that generic fluid milk advertising expenditures have significant increased consumers' demand for milk in general, and generic milk advertising is successful in building milk into part of people's lifestyle. This result is consistent with most of the previous milk advertising studies (Table 5.1.3), with the exception of *Kinnucan (1987)*. Previous studies suggested that milk advertising expenditures significantly increase consumer demand for milk, while *Kinnucan (1987)* indicated a negative milk advertising effects.

The cross generic milk advertising coefficient and elasticity estimates are statistically significant at the 5% level, and have positive signs for other beverage equations such as fruit juice (1996), vegetable juice (1996 and 2001), coffee and tea (1996), and soft drinks (2001). This result is consistent with the price effects, which suggest gross complements between beverage types. However, this result is not comparable to the previous studies (e.g. *Xiao et al. 1998*), in which advertising milk decreases the demand for juice, soft drinks, and coffee and tea for the reason of substitution relationships between different beverage types.

Generic milk advertising elasticities calculated by the five geographic regions, by three income levels, and two types of family structures are similar to the advertising elasticity calculated for the whole sample.

Table 5.1.3 Comparison of advertising elasticity estimates for fluid milk.

Study	Advertising elasticity
Kinnucan (1987)	- 0.0014
Goddard and Tielu (1988)	0.004
Kinnucan and Belleza (1991)	0.0278
Reynolds (1991)	37.554
Goddard and Cozzarin (1992)	0.22
Chung and Kaiser (2000)	0.0066
Xiao et al. (1998)	0.0018
This study generic advertising (2001)	0.045
This study generic advertising (1996)	0.043

Milk Brand Advertising

Milk brand advertising expenditures exhibit different effects on consumers' beverage demand between the 1996 sample and the 2001 sample. For the 1996 sample, both the own milk brand advertising coefficient estimate and the elasticity estimate are significant at 5% significance level and have positive signs. This suggests that brand milk advertising is effective in increasing consumers' milk consumption.

For the 2001 sample, both the own milk brand advertising coefficient estimate and the elasticity estimate are not statistically significant. This may be due to the fact that the quantity of "milk" is a simple summarization of the quantities of all the detailed milk products such as whole milk, 1% milk, 2% milk, skim milk and specialty milk. The brand milk advertising campaign usually targets on a specific milk product or one series of products within a particular brand, the campaign may not be effective for milk consumption in general. Noticeably, brand milk advertising tends to significantly increase demand for other types of beverage products. This is consistent with the results of generic milk advertising effects and non-existence of the substitution relationships between different beverage types. The results of brand advertising effects from this study is not compatible with the previous milk advertising effectiveness studies, in which only generic advertising expenditures are used in their estimation.

Brand milk advertising elasticities calculated by different demographic groups have similar results with the elasticities calculated with the whole sample in both 1996 and 2001.

5.1.5 Socioeconomic and Demographic Variables

The impacts of socioeconomic and demographic variables on non-alcoholic beverage consumption will be discussed in this section. Most of the estimates of the socioeconomic and demographic variables are statistically significant, and provide messages that are useful for assessing marketing strategies and social policies.

Household Income

Total household income is included in both stages of the demand system as an explanatory variable. With both the 1996 and 2001 samples, the coefficient estimate is statistically significant at the 5% level, and has a positive sign in the first stage estimation results, indicating that household income has a significantly positive impact on total beverage consumption. As total household income increases, consumers tend to purchase more non-alcoholic beverages. Previous studies (e.g. *Goddard and Tielu, 1988*) presented similar results, suggesting consumers' beverage consumption increases with the increase of their disposable income.

At the second stage, household income has different effects on people's consumption for different types of beverages. With an increase in the total household income, the consumer is likely to decrease the consumption for fluid milk products, vegetable juice, soft drinks (1996 and 2001), and coffee and tea (1996), increase the consumption on fruit juice (1996 and 2001).

Age

The age of the household reference person enters both stages of the demand function as a continuous variable. From the results of the first stage, people's consumption for total beverage increases as they become older (1996).

For both the 1996 and 2001 samples, household milk consumption goes up with the increase of the reference person's age. This result confirms that the health function of the fluid milk products is well accepted by consumers. With the increasing number of aging population, Canadians are becoming more health conscious. Nation wide television and internet campaigns promote healthy eating and life style. Milk, especially multi-vitamin and mineral fortified milk, is consumed more as a functional food, which is a good source of healthy ingredients, such as calcium, vitamins and other minerals. This result confirms the one presented by *Xiao et al. (1998)*, which suggests age has significant positive effects on milk consumption. However some previous studies do not provide similar results, for example results in *Venkateswaran and Kinnucan (1990)* and *Kinnucan and Belleza (1991)* suggested that milk consumption decreases as people age.

In the fruit juice and vegetable juice share equation, with the exception of vegetable juice for the 1996 sample, results do not show that age is a significant factor that drives households' consumption on the two beverage types.

For the soft drinks expenditure share equation, age is statistically significant (at the 5% level), and has a negative sign for both the 1996 sample and the 2001 sample. This result indicates that consumers tend to purchase less soft drinks when they grow older. *Xiao et al. (1998)* gave similar results in their analysis.

At the coffee and tea equation, the age coefficient is statistically significant and positive for both 1996 and 2001. This suggests that older consumers tend to purchase more coffee and tea from stores than younger consumers. Young consumers might purchase coffee and tea in restaurant and cafeteria more than they prepare them at home.

Gender

Two gender dummy variables, male and female, are generated for the household reference person in order to capture the different purchasing pattern due to the gender difference. The "male" variable is included in both stages of the demand system. Most of the coefficient estimates are not statistically significant, suggesting that there is no significant difference in beverage demand between males and females. The reason may be that the majority of Canadians choose foods based on what the whole family enjoys (*Decima Research Inc. 2004*).

Urbanity

Based on the size of the area where the interviewed household lives, two dummy variables, urban area and rural area, are generated and integrated into both stages of the demand system estimation. The coefficient of "urban" is statistically significant at the 5% level, and negative at the first stage, indicating that people in the urban area are likely to purchase less beverages in total than people in the rural area (1996 and 2001).

The estimates of "urban" are statistically significant at the 5% level, and have a negative sign for milk (1996), and coffee and tea (1996 and 2001). This result implies that consumers in the urban area tend to purchase less milk, and coffee and tea as opposed to consumers in the rural area.

The estimates of "urban" are statistically significant at the 5% level and have a positive sign for fruit juice, vegetable juice (1996 and 2001) and soft dinks (1996), indicating that consumers in the urban area are likely to purchase more fruit juice, vegetable juice and soft drinks.

Presence of Children in the Household

To investigate the impacts of household composition on beverage demand, two dummy variables are generated: one is "couple with children" and the other one is "other types of household". "Couple with children" is incorporated into both stages of the demand system estimation.

At the first stage, "couple with children" is statistically significant at the 5% level, and positive, suggesting that households with children are likely to consume more non-alcoholic beverage products in total as opposed to other types of households.

At the second stage, "couple with children" are statistically significant at the 5% level, and positive for milk (1996 and 2001). Compared to other types of households, households of "couple with children" tend to purchase more milk. This result reflects that consumers realized the significant health benefits of milk for children, who are in the growing stage and need calcium to help build strong bones and teeth. Milk is an easy media to absorb necessary healthy nutrients such as calcium.

At the fruit juice, the vegetable juice, and the soft drinks equation, "couple with children" is also significantly positive at the 5% level for both the 1996 and 2001 samples, indicating that this type of households are likely to buy more fruit juice, vegetable juice and soft drinks than other types are. On the other hand, "couple with children" is statistically significant at the 5% level, has a positive sign at the equation of milk, fruit juice, and soft drinks, and a negative sign at the coffee and tea equation. This is consistent with the result of "age", which suggests older people tend to consume more coffee and tea.

5.2 Non-alcoholic Beverage Demand in a Blockwise Dependent Structure

The results from a general beverage demand model have been discussed in the previous section. By ignoring the difference between detailed product items, the amount of detailed products that a household purchased was aggregated together to generate the expenditure for the five major types of beverages. This treatment not only covers the heterogeneity between the detailed product items, but also masks the different consumption trends of detailed products associated with different end-uses. Breaking general milk into three detailed fluid milk products, including whole milk, 2% milk and other milk, may be helpful to picture different characters of product demand. This section will discuss the results from the demand model in a blockwise dependent framework (Table 5.38 – Table 5.72 in Appendix A). The blockwise dependent AIDS model incorporate the same variables and follow the same variable specifications decided in Section 5.1.1.

5.2.1 Model Specification Tests

Before the estimation of the blockwise dependent beverage demand system, model specification tests, including the product aggregation test and the Lewbel – AIDS test, are conducted to decide whether the model specification is appropriate.

The product aggregation test is conducted to see whether the specification of product desegregation for various types of milk is appropriate. The hypothesis and the test results are listed in Table 5.2.1. The Chi-square test is statistically significant at the 5% level, and the hypothesis of product aggregation is rejected. Therefore, there is evidence suggesting that the specification of product disagregation in the blockwise dependent framework is appropriate.

Table 5.2.1. Results of product aggregation test for the blockwise dependent model.

Hypothesis	Test results	
H_0: Milk products can be aggregated.	1996 sample	2001 sample
	Chi-square = 2299.764* (df = 9)	Chi-square = 1273.262* (df = 9)

* Statistically significant at the 5% level.

The Lewbel – AIDS test is conducted to determine whether the use of the AIDS model is appropriate for the blockwise dependent beverage demand estimation. The test hypothesis is that the AIDS model is not nested properly in the Lewbel estimation. The test result is listed in Table 5.2.2. The Chi-square statistics is significant at the 5% level, and the hypothesis is jointly rejected. Therefore, using the AIDS model for the blockwise dependent beverage demand is appropriate.

Table 5.2.2. Results of nested test of Lewbel-AIDS.

Hypothesis	Test results	
	1996 sample	2001 sample
H_0: AIDS model is not nested in the Lewbel model properly.	Chi-square = 51691.446 * (df = 5)	Chi-square = 26350.058 * (df = 5)

* Statistically significant at the 5% level.

5.2.2 Price effects

Both the price coefficients and elasticities suggest that the three types of fluid milk products are net substitutes to each other. The results of cross-price elasticities in the blockwise dependent demand system illustrate clearer substitute relationships between beverage types, especially the three types of fluid milk, compared to the cross-price elasticities from the general beverage demand system. Consumers residing in Quebec are found to be more loyal to the high fat fluid milk products than consumers in other regions.

The own-price coefficients for the seven types of beverages are negative and statistically significant at the 5% level. The cross-price coefficients for the three detailed fluid milk products are positive and significant (5% level), and some of the cross-price coefficients for other beverage types are positive and significant (5% level).

All the own-price elasticities are negative and statistically significant at the 5% level, suggesting that all the beverage products, including the three types of fluid milk products, are normal goods. With the exception of fruit juice (1996), most of the own-price elasticities are less that -1, indicating that the beverage demand is price elastic, and decreasing prices of the goods in a small rate will increase the consumption of the associated goods at a bigger rate.

The changing pattern of price effects for the three types of milk reflects changes in consumers' attitudes towards milk products over time. For the 1996 sample, the own-price elasticity for other milk (1%, skim and specialty milk) has the biggest magnitude among those of the three types of milk. Most of the specialty milk products are innovative or novel foods, such as vitamin enriched milk, calcium enriched milk, and lactid acid fortified milk, which are targeted to special consumer groups, and consumers' awareness and acceptance of these products are not fully developed. Thus, the demand for the specialty and skim milk is easier to be influenced by the change in prices as opposed to other conventional milk products.

For the 2001 sample, the magnitude of the whole milk own-price elasticity is the biggest among the three milk own-price elasticities, indicating that consumers are more price sensitive for the whole milk than other types of milk. This may be due to the fact that consumers are becoming increasingly conscious about the fat content in fluid milk products, as they are exposed to more and more media coverage that promoting the low fat milk or skimmed milk. This is consistent with the result of positive milk health information in Section 5.1.3. Over time, for example from 1996 to 2001, consumers have gradually accepted various types of low fat milk and specialty milk. Compared to the other two milk types, 2% milk has the smallest own-price elasticity and the biggest expenditure share (Chapter Four), indicating that 2% milk has become the predominant milk product consumed in Canada, and its demand is least affected by price changes.

The cross-price elasticities of the three types of fluid milk are positive and significant at the 5% level, suggesting a net substitution relationship clearly exists between the three types of milk products. The cross-price elasticities of three types of milk products and other beverage types do not suggest net substitute relationships between milk types and other beverage types. Some of the cross-price elasticities of the other four major beverage types are significant and positive, suggesting that there are net substitution relationships between them. For example, fruit juice – vegetable juice (1996 and 2001) and soft drinks (1996), vegetable juice – soft drinks, and coffee and tea (1996 and 2001) are net substitutes for each other.

All the own-price elasticities calculated by different demographic groups are statistically significant at the 5% level and have negative signs. From the elasticities calculated by regions, whole milk consumption is the least price elastic for consumers in Quebec, and is the most price elastic for consumers in Ontario (1996 and 2001). The demand for 2% milk is the least price elastic for consumers in Quebec (2001) or for consumers in Ontario (1996); and the demand is the most price elastic for consumers in the Prairie region (2001) or B.C. (1996). As for the demand for other types of fluid milk products, consumers from Quebec are the most price sensitive (1996 and 2001), and consumers from B.C. (2001) or the Prairie region (1996) are the least price sensitive. The cultural difference between regions may contribute to these results. Quebec consumers traditionally drink milk with a higher fat content, and their preference for milk fat has not changed much since the mid 1990's (*Zhang and Goddard, 2004*). As well, consumers in Quebec tend to retain a more traditional cooking style, and use more high fat milk.

All the own-price elasticities calculated by income groups are statistically significant (5% level) and negative. Among three groups with different household income levels, consumers with low household income are the least price sensitive on the consumption of whole milk and 2% milk, and they are also the most price sensitive on the consumption of other milk (1996 and 2001).

The own-price elasticities calculated by family structures are all statistically significant (5% level) and negative. "Couple with children" households are less price sensitive on demand for whole milk relative to other types of households. This is consistent with previous studies (*Bus and Worsley, 2003*), in which households with children are found to be more likely to purchase whole milk. However, households of "couple with children" are more price sensitive on demand for 2% milk and other milk than other types of households (1996 and 2001).

5.2.3 Health Information Effects

The health information effectiveness analysis is broken down into detailed milk products. Through this procedure, it is able to take a closer look at the effectiveness of various types of beverage health information on impacting beverage demand, especially the three types of fluid milk products. The results show different health information effects in this model than those from the general beverage demand model.

Positive Milk Health Information

The coefficient estimates for positive milk health information are statistically significant (5% level) and negative for the whole milk equation (1996) and the fruit juice equation (2001), positive for the 2% milk equation (2001 sample, significant at the 20% level), the other milk equation (1996) and the soft drinks equation (2001).

Similar results appear in the estimates of positive health information elasticities. With the 1996 sample, positive milk health information has a statistically significant (5% level), and negative impact on whole milk demand, and positive impact on other milk demand. Positive milk health information has no impacts on consumer demand for other types of beverages. With the 2001 sample, positive milk health information has a significant (15% level) and positive influence on 2% milk consumption, and a negative influence on other milk. Positive milk health information also has a negative impact on fruit juice consumption. The results suggest that the positive milk health information is effective in increasing demand for certain types of milk, such as 2% milk and other milk.

The health information elasticities calculated by regions suggest that positive milk health information is the most effective in increasing demand for other milk products in Quebec (1996). This result is consistent with *West and Larue (2004)*, in which consumers residing in Quebec are found to be the most willing to be innovative in the nutritionally enhanced-food market.

Elasticities calculated by income levels show that among the three household income levels, consumers with high income level are most likely to decrease their consumption for whole milk (1996), when receiving more positive milk health information.

Elasticities calculated by family structures indicate that households of "couple with children" are the more likely to increase their consumption on other milk (1996), when receiving positive milk health information. This is may be because the presence of children in a household makes the household more health conscious than other types of household. This finding is also consistent with *West and Larue (2004)*, in which consumers with children present in the household are among the group who are the most likely to try nutrition-enhanced food products.

Negative Milk Health Information

The results of negative milk health information complement the ones from the general beverage demand system by clarifying that spreading of the negative milk health information is effective in reducing the demand for certain types of milk and increasing the demand for other types of beverages.

For the 1996 sample, both the coefficient and elasticity estimates are significant (10% level) and negative at the other milk equation. This indicates that consumers tend to reduce consumption of other milk when receiving negative milk health information. For the 2001 sample, however, both the coefficient and elasticity estimates of negative health information are statistically significant (5% level) and positive at the other milk equation. This result suggests that people tend to switch from whole milk to other milk when they received more negative milk health information.

These controversial results may be due to the changed content of the negative information from 1996 to 2001. In 1996, it was about the connection between fat content in milk and health. However in 2001, the negative milk information was centered on animal welfare issues. Therefore it is possible to speculate that in 2001 the negative information effects are outweighed by the healthy aspects of other milk. Another possible explanation for the apparently contradicting results is that consumers were being sent conflicting messages about milk, so more time would be needed to draw solid conclusions.

Elasticities calculated by regions suggest that negative milk health information is the most effective in Quebec for both the 1996 sample and the 2001 sample. This is consistent with the results of positive health information effects.

Elasticities calculated by income levels show that people with high household income (1996) response more actively to the negative health information with both the 1996 and 2001 sample. This is also consistent with the positive health information effects.

Negative milk health information elasticities calculated by family structures indicate that "couple with children" are more responsive to the negative milk health information. Parents appeared to be more sensitive to the changes of health information on milk, perhaps because they have the best interests of their children in mind when purchasing foods.

Fruit Juice Health Information

Fruit juice health information has different effects on people's beverage consumption between the 1996 sample and the 2001 sample. In 1996, the fruit juice health information elasticity is statistically significant (5% level), and positive at the 2%

milk equation and the soft drinks equation, and it is also statistically significant (5% level), and negative at the other milk equation and the coffee and tea equation.

With the 2001 sample, the fruit juice health information elasticity is statistically significant (5% level), positive at the fruit juice equation, and negative at the other milk equation. This result indicates that fruit juice health information is effective in increasing the demand for fruit juice, and decreasing the demand for other milk.

Elasticities calculated with different geographic regions, income levels and family structures are similar with those calculated with the whole sample.

Vegetable Juice Health Information

The elasticity estimate of vegetable juice health information is statistically significant (5% level) and positive at the fruit juice equation (2001), and the other milk equation (5% significance level for the 1996 sample, and 10% level for the 2001 sample). Although vegetable juice health information does not directly affect demand for vegetable juices, it tends to increase consumer demand for healthy drinks such as fruit juice and other milk.

Elasticities calculated by geographic regions, income levels and family structures are similar with those calculated with the whole sample.

Soft Drinks Health Information

The elasticity estimate for soft drinks health information is not statistically significant for all the beverage types. This result suggests that soft drinks health information is not effective to influence consumers demand for most of the beverage types. Elasticities calculated by different regions, income levels, and family structures have similar results as those calculated with the whole sample.

5.2.4 Advertising Effects

Generic milk advertising is effective in increasing certain types of milk demand. Milk brand advertising has positive impacts on the demand for certain types of milk, and the products being affected changed over time. The results from this model further elaborate the effectiveness of milk advertising on different detailed products.

Generic Milk Advertising

For both coefficient estimates and elasticity estimates, the generic advertising coefficients are statistically significant (5% level), positive at the 2% milk equation (1996 and 2001), and negative at the other milk equation (1996) and the coffee and tea equation (1996 and 2001). This result indicates that generic milk advertising expenditures have no influence on consumer purchasing decisions for whole milk, but effectively increase consumers' demand for 2% milk and decrease consumer demand for other milk products, and coffee and tea. As there are no clear substitute relationships between different types of beverages, the generic milk advertising either has unclear or has no impact on consumer demand for other beverage types.

Advertising elasticities calculated by regions show that the generic milk advertising was the most effective in increasing 2% milk demand in B.C., and the generic milk advertising was the least effective in increasing 2% milk demand in Quebec (2001). The results also show that, for the 1996 sample, the generic advertising expenditures increased the demand for other milk the most in B.C., and the least in the Atlantic region and Ontario.

Milk Brand Advertising

For the 1996 sample, the coefficient estimate and the elasticity estimate of milk brand advertising are significant (5% level), positive in the 2% milk, the fruit juice equation, and the soft drinks equation, and negative in the coffee and tea equation. With the 2001 sample, brand milk advertising coefficients and elasticities are statistically significant (5% level), positive in the whole milk equation, the fruit juice equation and the vegetable juice equation, and negative in the other milk equation and soft drinks equation.

The positive effects of brand advertising expenditures shift from 2% milk in 1996 to whole milk in 2001. Brand milk advertising has negative effects on other milk in the 2001 sample. Reasons for these results may be two fold: first, the brand advertising is targeted to specific consumer groups and is designed to promote certain products; second, companies may change and adjust their advertising targets according to the market situation and consumer trends over time.

Elasticities calculated by regions suggest that, among the five regions, people in B.C. are the most likely to increase their consumption of 2% milk (1996). With the 2001 sample, compared to consumers residing in other regions, consumers in Ontario are more likely to increase their consumption of whole milk, and people in Quebec are more likely to decrease their demand for other milk. These two provinces have a large urban population, and consumers are more exposed to the media, and leading a more modern lifestyle habits (*West and Larue, 2004*). Therefore, they are more easily to be influenced by media advertising.

Elasticities calculated by income levels show that consumers with high household income level are more actively to increase their whole milk consumption (2001) and 2% milk consumption (1996) in response to the increase in milk brand advertising expenditures, and people with low household income level are more likely to reduce their consumption of other milk than households with higher income level (2001).

Elasticities calculated by family structures suggest that milk brand advertising is more effective on "couple with children" in increasing their demand for 2% milk (1996) and reducing their demand for other milk (2001).

5.2.5 Socioeconomic and Demographic Variables

The effect of the socioeconomic and demographic variables on household beverage demand is discussed in this section. Most of the estimation results are consistent with those from the general beverage demand model.

Age

The coefficient estimates of age are consistent with those from general beverage demand system in terms of the significance level and the sign. Age is statistically significant (5% level) and positive at the first stage, indicating that people tend to purchase more total beverage products when they grow older (1996 and 2001).

The age coefficient is significant (5% level) and has a positive sign at the 2% milk expenditure share equation for both the 1996 sample and the 2001 sample. This result confirms the one from the general beverage demand system, and further demonstrates that consumers consume more 2% milk as opposed to whole milk and other milk types. Age is also statistically significant (5% level) and negative at the soft drinks equation, suggesting that people tend to purchase less soft drinks when they age. Coffee and tea equation has a statistically significant (5% level) and positive age coefficient estimate, implying that older people are more likely to purchase coffee and tea at grocery stores than younger people.

Urbanity

The urban dummy variable is statistically significant (5% level) and negative at the first stage estimation for both the 1996 sample and the 2001 sample. This indicates that people in the urban area are likely to spend less on beverages then people in the rural area are.

At the second stage, the urban dummy is statistically significant (5% level) and negative at the whole milk equation, vegetable juice (1996 and 2001), and the soft drinks equation (2001). These results show that people in the urban area purchase less whole milk, vegetable juice and soft drinks products.

The urban dummy is statistically significant (5% level) and positive at the other milk equation (2001), indicating that consumers at the urban area are more likely to try new and nutrition-enhanced milk products. This result is consistent with the one presented in *West and Larue (2004)*, in which they found metropolitan consumers appear to be the most willing to be innovative in the functional food market.

Household Composition

"Couple with children" is statistically significant (5% level) and positive at the first stage, suggesting that this type of households tend to purchase more beverage products than other types of households.

At the second stage, "*couple with children*" is statistically significant (5% level) and positive at the whole milk equation (1996 and 2001), the 2% milk equation (1996 and 2001), and the fruit juice equation (1996). These results suggest that the presence of children in a household positively influence the milk consumption, especially the consumption of whole milk and 2% milk. Previous studies (e.g. *Bus and Worsley, 2003*) also found similar results that consumers perceive whole milk as more beneficial to children's health.

"Couple with children" are statistically significant and negative in the other milk equation (1996 and 2001), the vegetable juice equation (1996 and 2001), the soft drinks equation (2001), and the coffee and tea equation (1996 and 2001). These results show that parents are less likely to purchase beverages such as coffee and tea, other milk and vegetable juices.

5.3 Summary and Conclusion

The estimation results from both the general beverage demand model and the blockwise dependent beverage demand model are reported in this chapter. The discussion of estimation procedures, various tests, coefficient estimates and elasticity estimates are presented in the previous sections. Differences exist in results between the general beverage demand system and the blockwise dependent beverage demand system. These differences may be due to different functional form (Lewbel versus AIDS) as well as the function structure. The major findings from the beverage demand estimations will be summarized in this section.

General Beverage Demand System

Own prices of the five major beverage types are found to be a significant factor in consumers' consumption decisions. With the exception of vegetable juices, most of the beverage types are price elastic. "Couple with children" type of households are more price sensitive for the five beverage types.

Health information is effective in influencing people's beverage purchasing decision with varying impacts from year to year. Positive milk health information did not always positively impact milk demand. For example, it had positive effects in 1996, but had negative impact in 2001. Positive health information promoting low-fat milk may actually hurt demand for milk in total. "Couple with children" and households with higher income respond to the positive milk health information more actively.

Negative milk health information was effective for the 1996 sample in reducing milk demand. Households with higher income level and households with children are more likely to drop their milk consumption because of health concerns over milk. However, negative health information without sound scientific evidence, for example a simple statement as "*milk sucks*", do not make Canadians drink less milk. This is true for the 2001 sample.

Other three types of beverage health information are also influential in changing consumer demand for beverages. For example, people will increase their demand for fruit juice when they receive more fruit juice health information. The vegetable juice health information will indirectly increase consumers' demand on healthy drinks, such as milk and fruit juice. On the other hand, people tend to drop their demand for soft drinks when they receive more soft drinks health information.

Generic milk advertising has significantly increased people's general milk consumption. The branded milk advertising increased milk demand for the 1996 sample but had no impact in the 2001 sample; this may be due to the fact that the targets of company promotion varied over time. These results may also reflect that milk advertising, especially the generic milk advertising, successfully made milk become part of consumers' lifestyle.

As of demographic profiling, older people were likely to purchase more milk and coffee and tea, and less soft drinks. Higher income households tend to purchase more fruit juice, vegetable juice and soft drinks, while lower income households tend to purchase more milk and coffee and tea. Consumers residing in urban areas favor fruit juice, and coffee and tea over milk, vegetable juice and soft drinks. Except for coffee and tea, households with children significantly consume more beverage than other types of households.

Beverage Demand System in A Blockwise Dependent Framework

The product aggregation test demonstrates that the beverage demand system in a blockwise dependent framework is an appropriate specification for fulfilling the objectives of this study. On the blockwise dependent platform, three types of milk show a clear net substitute relationship. Consumers residing in Quebec are found to be more loyal to whole milk, and consumers from Ontario are more price-sensitive for whole milk. Households of "couple with children" are less price-sensitive to all milk types (1996), especially for whole milk.

The milk health information is influential on the demand for certain types of milk. Positive milk health information is effective in promoting the demand for 2% milk (2001). It also tends to reduce the demand for whole milk (1996). Quebecers, lower income households, and "couple with children" are more responsive to the positive milk health information.

In contrast, when people receive more negative milk health information, they will change their consumption on milk products. The effects varied in the two samples. Consumers residing in Quebec and Ontario and "couple with children" tend to be more responsive to the negative milk health information.

Some of the other types of beverage health information are also significant in influencing the consumer demand on beverages. For example, the fruit juice health information significantly increases the demand for fruit juice and decreases the demand for other milk (2001).

This demand system also provides a clearer picture for milk advertising effects, with milk broken down into three types. For example, generic milk advertising is effective in increasing 2% milk consumption, and brand milk advertising also tends to increase the demand for 2% milk (1996).

Consumers' preferences for milk types also vary with their demographic characteristics. For example, people tend to purchase more 2% milk in particular when they become older. Consumers in the urban area are more likely to consume less whole milk, 2% milk, but more other milk. "Couple with children" type of households tend to buy more whole milk and 2% milk, and less other milk.

The results summarized above provide the government, various social health organizations and the industry with detailed and useful information to help them identify market opportunities and construct marketing strategies in providing consumers healthier beverage choices. The summary, implications and the limitations of the thesis will be presented in the next chapter.

Chapter 6 Summary and Implication

A summary of the thesis, a review of the study objectives, the implications of the results, and the study limitations and potential areas for further study will be presented in this chapter.

6.1 Summary of Thesis

This thesis examined household demand for non-alcoholic beverages in Canada. For the past 20 years, fluid milk consumption has been decreasing, while soft drinks, juices and bottled water have experienced growing demand. In the mean time, consumers have switched from whole milk to partly-skimmed and skimmed milk. Consumers' concerns over health issues surrounding beverage consumption, and the expenditure on generic and branded fluid milk products are factors that affect Canadian consumers' purchasing decisions, as well as product prices, and consumer demographic variables.

By applying consumer demand theory and econometric techniques, a two stage flexible (*Lewbel, 1989*) beverage demand system is estimated, using Canadian Family Food Expenditure Survey data (*Statistics Canada, 1996 and 2001*) and incorporating health information and advertising variables, in order to uncover the factors that influence consumers' beverage demand. In addition, to differentiate the demand characteristics of the three different types of fluid milk products in the whole demand system, an AIDS model estimation in a blockwise dependent framework is conducted.

This study directly complements previous studies of beverage and fluid milk demand in Canada in several aspects:

1) Using micro level household survey data in the beverage demand estimation;

2) Incorporating health information and advertising variables into the beverage demand system;

3) Constructing a complete list of non-alcoholic beverage health information indices related to consumption of milk, fruit juice, vegetable juice, and soft drinks;

4) Employing a flexible demand system proposed by *Lewbel (1989)*;

5) Applying a blockwise dependent AIDS model to capture different demand characteristics of three types of milk.

An overview of the Canadian dairy industry and consumer trends for milk and other beverages is provided in Chapter One. Factors that may contribute to influencing consumers' purchasing decisions are discussed, such as health information, advertising variables, and changing Canadian demographics. Based on the consumption trend of non-alcoholic beverages in Canada, a range of study objectives to be achieved in this thesis are also identified in this chapter.

A comprehensive review of the agricultural economics and marketing literature related to the non-alcoholic beverage demand in Canada is presented in Chapter Two. The sections included in the complete literature review are:

1) Basic consumer demand theory;

2) Demand model specification – single equation or demand system, weak separability, and a blockwise dependent structure;

3) Consumer behavior and informational variables – how to incorporate informational variables into a demand function;

4) How to incorporate demographic variables into a demand function;

5) How to construct health information indices;

6) Choices of different demand systems;

7) Selection between time series data and cross-sectional data;

8) Econometric problems associated with cross-sectional data estimation;

9) Previous studies related to non-alcoholic beverage demand in Canada and other countries.

Building on economic theory and previous findings related to the study topic, the theoretical framework was constructed in Chapter Three in order to fulfill the study objectives. The models and the methods that are used in the beverage demand estimation was described in this chapter:

1) Consumer demand for non-alcoholic beverages – a list of the non-alcoholic beverage products, and demand for beverage products is weakly seperable from all other goods;

2) A complete flexible beverage demand system (*Lewbel, 1989*), which nests both the AIDS and Translog models, that is used in this study;

3) A complete AIDS model in a blockwise dependent structure.

The data that are used in the estimation is described in Chapter Four, including FFES data, advertising expenditures and health information indices. FFES is a micro level household consumption data conducted by Statistics Canada every four years. This study uses the latest two samples (1996 and 2001) in the estimation. The quantity and expenditure of purchased beverage types were recorded for each household who participated in the survey in a two week period, as well as the quarter that the interview happened and the demographic characteristics of each household. Advertising expenditure data include generic milk advertising expenditure and brand milk advertising expenditures. Generic milk advertising data are obtained from annual reports of the provincial dairy commodity board. Brand milk advertising data are estimated media advertising expenditures from ACNielsen. Health information indices include the positive and negative milk health information indices, fruit juice health information index, vegetable juice health information index, and soft drinks health information index. Health information indices are constructed by searching major Canadian newspaper articles that contain health information related to beverage consumption in the sample period through the public library internet search engine (*Dow Jones*, *Factiva* and *Canada Newsstand*), and then counting the number of articles searched. Positive health information is hypothesized to have a positive impact on boosting the beverage demand, while negative health information is hypothesized to have negative impact on beverage demand.

The estimation results of the general flexible beverage demand model and the results of the linear AIDS model in a blockwise dependent structure are reported and discussed in Chapter Five. In general, estimation results show that prices are the major factors that drive the household demand for non-alcoholic beverages. Various informational variables, such as positive and negative milk health information and milk advertising expenditures, are effective in changing consumer beverage demand. Age, urbanity, income and presence of children in the household are important factors affecting beverage consumption out of all of the possible demographic variables. The results of the product aggregation tests suggest that the model specification in a blockwise dependent structure is appropriate for capturing different demand characteristics of the three milk types.

In the next section, the thesis objectives will be reviewed, and a clearer picture of Canadian household demand for non-alcoholic beverages will be provided as well.

6.2 Review of Thesis Objectives

Four major objectives are defined for this study:

1) Describing the household demand for fluid milk and other non-alcoholic beverages in Canada, and analyzing the influence of consumers' demographics on beverage demand;

2) Examining the effectiveness of various informational variables such as beverage health information and advertising expenditures on beverage demand;

3) Recognizing different demand characteristics for disaggregated product types, especially the three types of milk products;

4) Developing implications for social and marketing strategies to promote healthier drinking choices for Canadian consumers.

The first study objective is achieved by analyzing the micro level household food expenditure survey data and estimating a general beverage demand system. From both the 1996 and the 2001 sample, fluid milk and soft drinks are the two major non-alcoholic beverage types in Canadian household food consumption, and they have the biggest shares in the total beverage expenditure. Changes in own-product prices are a significant factor that drives beverage demand; all beverage types are quite price elastic. No clear substitution relationships exist between the five major beverage types. Age, presence of children in the household, and residence in the rural or urban area are significant demographic variables affecting consumers' beverage purchasing decisions. For example, households of "couple with children" significantly consume more fluid milk than other types of household do, and people tend to consume more milk when they age.

As to the second objective, a comprehensive list of indices are constructed for positive milk health information, negative milk health information, fruit juice health information, vegetable juice health information, and soft drinks health information. These variables, milk generic advertising, and brand milk advertising expenditures are integrated into the beverage demand system analysis. Advertising expenditures are effective in increasing consumer demand for milk. The effects of informational variables vary over time and by different demographic groups, products and information sources.

Regarding the third objective, different demand characteristics for the three types of fluid milk products are captured by estimating a blockwise dependent AIDS beverage demand model. Compared to the other two types of milk, 2% milk has the biggest expenditure share out of the total beverage expenditure. Whole milk, 2% milk and other milk have a clear net substitution relationship between each other. Advertising and health information are effective in changing demand for different types of milk. For example, generic milk advertising significantly increased demand for 2% milk in both 1996 and 2001, but had no impact on consumption for whole milk.

The fourth objective is to use the study results to develop implications to help assess social and marketing strategies. This study reflects the real situation of consumer demand for milk and other non-alcoholic beverages by using the micro level household survey data and excluding the quantity for industrial and restaurant use. Empirical results of price and income effects, demographic effects, and advertising and information effects can be applied to social marketing strategies promoting the healthy drinking concept and industry promotion campaigns aiming at the improvement of market shares for beverage demand. Detailed policy implications are discussed in the next section.

6.3 Marketing and Policy Implications

Policy implications that are derived from this thesis are presented in this section. Consumers are receiving health information about foods from various sources, including product prices, nutrient contents claimed on food labels, product advertising programs, health information published in the mass media and government and non-government organizations, and advise from medical doctors. The information may change people's knowledge and perceptions about one product, and in turn change their valuation of the cost and benefits gained from the product, thus potentially changing their purchasing behavior. The effects of the information vary from one individual to another, depending on the demographic characteristics of the shopper and the product attributes. The impacts from various types of information working together will be different as opposed to one type of information working alone. These should be all factored into the process of policy making.

Milk, fruit juice, vegetable juice, soft drinks, and coffee and tea are five major categories of non-alcoholic beverages in Canada. Price changes significantly change consumer demand for beverages. Households with children are more responsive to the changes in beverage prices. The substitution relationships between the five beverage types are ambiguous, but the three types of fluid milk products show clear substitution relationships. Consumers residing in Quebec have strong preferences for milk with a higher fat content.

People are increasingly health conscious. Health information grounded in science is effective in altering consumer beverage demand. However, there is much ongoing controversy with respect to different types of health information. For example, milk is largely promoted as a healthy drinking choice, but it is also seen as a major source of dietary fat. Another example is that most of the health information on fruit juices is positive with a few exceptions stating that fruit juice is less healthy than real fruit due to the loss of fiber in the juice. The controversy causes consumers' confusions and misperceptions about health benefits over beverage consumption. Other studies have shown that people do not need to receive more information. They need information that can convince them of the health benefits of certain products (*West et al. 2002*).

Access to and understanding of health information varies across individuals because of the differences in motivation and the level of exposure to the information sources. For instance, parents who have children living in the household pay more attention to health and safety issues, and are more active in responding to health information. Households with higher income are more responsive to health information. This may be because that they probably have more funding for searching information and access to information sources. Higher income levels are always associated higher education level. Hence, this group of consumes may have better basic food and nutrition knowledge, which help them better respond to the health information. Thus, an effective communication channel should be established by the government or non-government health/commodity organizations to make sure that the health information with scientific evidences can be received by the general public, so that consumers are able to fully realize the benefits of a healthy eating lifestyle.

Did milk advertising successfully promote milk consumption among Canadians? The answer is "yes", especially for certain detailed milk products. Generic milk advertising is effective in improving total sales of fluid milk products, and it is particularly influential in increasing certain types of milk consumption, such as 2% milk. The brand milk advertising is also effective in increasing the demand for certain types of milk products depending on what the targeted product is. Although having controversial health information, milk is a good vehicle for many healthy nutrients. This study suggests the dairy industry continue to promote their products with more focus on the health benefits of milk to help build consumers' confidence in milk consumption. In the mean time, a vast market exists for nutritionally enhanced specialty milk. The industry has already begun to work on niche marketing by producing nutrition-enhanced milk products. For example, dairy companies across Canada, such as Natrel, Neilson and Dairyland, have launched Omega 3 enriched milk in the market. Many other value-added milk products, such as lactose free milk, calcium enriched milk, vitamin enriched milk, and organic milk, are also available in the grocery stores. The entrance of these innovative products into the market will help change the image of milk, and reduce impact of negative health information on demand.

Results of demographic analysis provide policy makers with useful information for conducting social and marketing strategies. The aging of the population will be a social feature that has significant impacts on the food industry. In 2001, people aged 45 to 64 accounted for one-quarter of Canada's total population. This group is estimated to represent one-third of the total population by 2011. This study shows the health consciousness of older people; they will continue to seek out food and beverage choices that can promise good health and long life. More things can be done on packaging and nutrient content in the market targeted aging population. For instance, as old people's appetites get smaller, individual and single-serve products that are convenient and nutrient dense drinks will be more attractive in this market. On the other hand, young people are not choosing enough bone healthy drinks, and the health benefits of such products are not fully recognized among young people. They might have had more positive beliefs about milk when they were in childhood through school milk programs and their parents' purchasing. As they grow up, they may view milk as more expensive than and not as cool as soft drinks. More education is needed to alter their misperception about milk.

Children's health and safety put a significant weight on households' purchasing decisions. Households with children usually buy more beverages than other households, and also have strong loyalty to the bone health beverage. But as they purchase a large quantity of total beverage, their tolerance to the increase in prices becomes lower.

Metropolitan consumers are leading a more modern and busier lifestyle. Nutrition products in on-the-go, portable and convenient packages will make the product fit into the busy lifestyle. Consumers residing in the metropolitan area are also more exposed to the media, and tend to have more knowledge related to healthy eating. They form a huge potential market for innovative and nutrition-enhanced milk products.

6.4 Limitations and Potential Areas for Further Research

This study is unique in looking at the Canadian consumers' beverage demand by using a micro level household survey data and incorporating comprehensive informational variables into a flexible demand system. However, there are limitations with this study, including limitations in both data and methodology. The limitations of this study are discussed and potential areas for further research are identified in this section.

For advertising data, the demand analysis only includes advertising expenditures related to milk consumption. This puts limitations in giving a complete picture of the effectiveness of advertising on demand for all types of beverages. Except for fluid milk, advertising campaigns are conducted by the individual manufacturer, hence only brand advertising data are required. With detailed regional advertising data for more beverage types, the own-product and cross-product advertising effects could be looked at more closely. However, the high cost of the ACNielsen estimated data is always an impediment for obtaining more precise data.

Another limitation with the data is associated with the break down of the milk brand advertising. The milk brand advertising expenditures are annual quantity of media advertising expenditures estimated by ACNielsen. This is the best situation that we can get for approximating the milk brand advertising. However, the overall quality of the study could be improved by using more precise advertising data. If the brand advertising data could be broken down into quarter, it will provide more data variation for the estimation, and the demand estimation could also capture more information on consumer responses to advertising intensity.

With the methodology, the first limitation is the way of treating zero consumption in the micro level household survey data. The censoring nature with the micro level survey data is always a concern in demand analysis in the sense of reducing the estimation efficiency. The existence of zero expenditures in this study may be biasing some of the t-statistics of the estimates to large numbers. Although some cross-sectional data analysis ignores the zero expenditure problem (*Heien and Pompelli, 1988; Capps and Havlicek, 1984; Capps et al. 1985; Park and Davis, 2001; Chung and Kaiser, 2002; Abdulai, 2002; Abdulai and Aubert, 2004; Abdulai et al. 1999*), a large body of literature has developed econometric methods to deal with the problem of zeros since the 1950's.

The second methodological limitation is related to the way of modeling consumer heterogeneity factored by demographic variables, such as different geographic regions, income levels, and family structures. This thesis assumes that demographic variables are exogenous in changing consumer purchasing decisions with consumers' preference held constant across the whole sample. The alternative method is to estimate the demand system separately for different regions, income levels and/or family structures. Instead of assuming constant consumer preferences across the whole sample, this method will take a closer look at the impacts of demographic differences on consumption decisions.

Therefore, the potential for further research exists in several aspects: first, more attention could be paid to the treatment of the zero expenditures to test the efficiency of the demand estimation. Also, experiments can be conducted to estimate the beverage demand model by region, income levels and family structures separately, in order to relax the assumption of the constant preferences across the whole sample and to investigate changes in demand due to varying consumer' preferences in different demographic groups.

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Appendix A[6,7,8] Results Tables for the Estimation of Non-Alcoholic Beverage Demand Systems.

Table 5.3 Estimated coefficients at the second stage of the general beverage demand system, 1996 and 2001.

1996	*Price*					*Health Information*				
	Milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Positive milk	Negative milk	Fruit juice	Vegetable juice	Soft drinks
Milk	-0.0174	-0.0118	0.0146	0.0153	0.0811	0.0102	-0.0015	-0.0008	0.0022	0.0006
	(-2.3842)**	(-2.5657)**	(6.2007)**	(3.2619)**	(16.6997)**	(1.3893)	(-1.3951)	(-0.7943)	(2.2788)**	(0.6725)
Fruit juice		-0.0132	0.0149	-0.0016	0.0763	-0.0031	-0.0010	-0.0008	0.0001	-0.0006
		(-2.5916)**	(7.4113)**	(-0.4346)	(19.2568)**	(-0.5343)	(-1.2259)	(-0.9744)	(0.1181)	(-0.8993)
Vegetable juice			-0.0500	0.0162	0.1772	-0.0021	-0.0003	0.0004	-0.0004	0.0003
			(-18.3127)**	(9.2792)**	(87.6877)**	(-0.9593)	(-0.9123)	(1.3284)	(-1.3512)	(1.0811)
Soft drinks				-0.0465	0.1043	-0.0010	0.0032	0.0028	-0.0013	-0.0006
				(-8.9034)**	(26.5949)**	(-0.1418)	(3.1743)**	(2.9300)**	(-1.4236)	(-0.6966)
Coffee & tea					-0.4215)	-0.0040	-0.0004	-0.0017	-0.0006	0.0003
					(-35.3569)**	(-0.7240)	(-0.5081)	(-2.1406)**	(-0.8139)	(0.4967)
2001	*Price*					*Health Information*				
	Milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Positive milk	Negative milk	Fruit juice	Vegetable juice	Soft drinks
Milk	-0.0890	0.0044	0.0355	0.0333	0.0796	-0.0140	0.0002	-0.0036	-0.0010	0.0014
	(-6.9345)**	(0.5249)	(8.3311)**	(4.4256)**	(9.1184)**	(-1.3919)	(0.0998)	(-3.0285)**	(-0.6954)	(0.5411)
Fruit juice		-0.0267	0.0185	0.0042	0.0415	-0.0246	0.0012	0.0020	0.0020	-0.0001
		(-2.8712)**	(5.3328)**	(0.7022)	(6.6350)**	(-2.9306)**	(0.6950)	(2.0013)**	(1.6463)*	(-0.0269)
Vegetable juice			-0.0755	0.0159	0.1618	0.0013	-0.0005	0.0005	-0.0002	0.0008
			(-16.7005)**	(5.9874)**	(42.7764)**	(0.4466)	(-0.7695)	(1.2715)	(-0.5151)	(0.9914)
Soft drinks				-0.0639	0.0512	0.0448	0.0015	-0.0015	-0.0018	-0.0040
				(-8.0963)**	(8.4576)**	(4.7245)**	(0.7503)	(-1.3419)	(-1.2786)	(-1.6572)*
Coffee & tea					-0.3379	-0.0076	-0.0025	0.0027	0.0010	0.0019
					(-27.4595)**	(-1.0819)	(-1.6559)*	(3.2058)**	(0.9759)	(1.0716)

[6] Data source: Family Food Expenditure Survey data 1996 and 2001, Statistics Canada.

[7] Numbers in parentheses are t-statistics.

[8] * Statistically significant at 10% level; ** statistically significant at 5% level.

Table 5.3 Estimated coefficients at the second stage of the general beverage demand system (continuation), 1996 and 2001.

1996	*Advertising*		*Demographics*					*Expenditure*	*Constant*
	Generic Milk	Brand Milk	Age	Male	Couple with children	Urbanity	Household income		
Milk	-0.0033	0.0501	0.0004	-0.0031	0.0333	-0.0108	-0.0170	-0.0339	0.1487
	(-0.7271)	(3.5989)**	(2.0434)**	(-0.6058)	(5.7169)**	(-2.9805)**	(-2.3209)**	(-6.0541)**	(0.9619)
Fruit juice	0.0106	0.0214	0.0002	-0.0033	0.0454	0.0365	0.0180	-0.0681	-0.2654
	(2.8446)**	(1.9143)*	(1.3411)	(-0.7816)	(9.4487)**	(12.2119)**	(2.9738)**	(-15.1792)**	(-2.1089)**
Vegetable juice	0.0065	0.0259	0.0006	0.0121	0.0678	0.0434	-0.0137	0.0418	-0.1961
	(2.8975)**	(4.0344)**	(5.5608)**	(4.1176)**	(20.7504)**	(21.2005)**	(-3.2730)**	(15.8067)**	(-2.4712)**
Soft drinks	0.0019	0.0236	-0.0022	0.0235	0.0452	0.0280	-0.0041	-0.0589	0.1509
	(0.4128)	(1.7548)*	(-12.3600)**	(4.5698)**	(7.8305)**	(7.8055)**	(-0.5664)	(-10.8027)**	(0.9987)
Coffee & tea	-0.0292	0.0010	0.0168	-0.1917	-0.0971	-0.0156	-0.1211	0.1191	1.1619
	(-4.7356)**	(5.0063)**	(1.9265)*	(-27.8987)**	(-22.6705)**	(-3.2350)**	(-8.6729)**	(20.8198)**	(6.8933)**
2001	*Advertising*		*Demographics*					*Expenditure*	*Constant*
	Generic Milk	Brand Milk	Age	Male	Couple with children	Urbanity	Household income		
Milk	0.0067	-0.0654	0.0014	-0.0101	0.0466	-0.0104	-0.0053	-0.0248	1.35844
	(1.0942)	(-2.5859)**	(5.1407)**	(-1.2581)	(4.9233)**	(-0.9677)	(-0.8873)	(-2.2920)**	(4.51385)**
Fruit juice	0.0014	0.0625	-0.0002	-0.0054	0.0301	0.0325	0.0240	-0.04909	-0.6258
	(0.2647)	(2.9357)**	(-0.7145)	(-0.7954)	(3.7565)**	(6.4192)**	(2.6458)**	(-5.58676)**	(-2.4701)**
Vegetable juice	0.0073	0.0426	-0.0001	0.0008	0.0641	0.0392	-0.0235	0.04132	-0.34782
	(2.5886)**	(3.6253)**	(-0.4755)	(0.1963)	(13.0422)**	(12.5805)**	(-4.1561)**	(8.44604)**	(-2.40916)**
Soft drinks	0.0148	-0.0589	-0.0028	0.0128	0.0214	0.0052	-0.0313	-0.01455	1.00385
	(2.5220)**	(-2.4276)**	(-10.8150)**	(1.6428)*	(2.3346)**	(0.9028)	(-3.0141)**	(-1.41571)	(3.47557)**
Coffee & tea	-0.0301	0.0192	0.0017	0.0019	-0.1621	-0.0716	0.0411	0.047113	-0.38867
	(-5.4249)**	(0.8333)	(6.1693)**	(0.2340)	(-17.3232)**	(-12.0575)**	(3.8302)**	(4.31887)**	(-1.38877)

Table 5.4 The first stage coefficient estimates of the general beverage demand system, 1996 and 2001.

	1996		*2001*	
Parameter	Estimate	t-statistic	Estimate	t-statistic
Constant	-1.1864	(-3.1606)**	0.8649	(1.2016)
Price index	-0.2159	(-11.7480)**	-0.1422	(-4.4031)**
Generic milk advertising	0.0367	(3.5214)**	0.0542	(3.9386)**
Brand milk advertising	0.1465	(5.1613)**	0.0237	(0.4120)
Age	0.0020	(4.0476)**	-0.0008	(-1.0138)
Male	0.0457	(3.0868)**	0.0180	(0.8017)
Couple with children	0.4334	(26.7673)**	0.4704	(18.3328)**
Income	0.2449	(24.2113)**	0.2407	(14.8064)**
Urbanity	-0.0549	(-2.6107)**	-0.1145	(-3.8489)**

Table 5.5 Estimates of own- and cross-price elasticities of the general beverage demand system, 1996 and 2001.

	Price 1996					Price 2001				
Quantity of	Milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea
Milk	-1.1292	-0.0645	0.0129	-0.0493	-0.0397	-1.1056	-0.0308	0.0141	-0.0236	-0.0106
	(-69.1395)**	(-7.5266)**	(2.1383)**	(-5.1590)**	(-5.9834)**	(-61.793)**	(-3.5800)**	(2.8812)**	(-2.1126)**	(-0.7408)
Fruit juice	-0.1313	-1.0686	0.0128	-0.0508	-0.0405	-0.0843	-1.0959	0.0138	-0.0262	-0.0118
	(-10.8670)**	(-139.709)**	(28.1592)**	(-9.9475)**	(-14.1915)**	(-3.2215)**	(-27.4196)**	(15.3628)**	(-2.8336)**	(-2.7696)**
Vegetable juice	-0.1124	-0.0230	-0.9540	-0.0493	-0.0396	-0.0569	-0.0133	-0.9497	-0.0242	-0.0109
	(-14.7725)**	(-6.5495)**	(-144.677)**	(-9.9610)**	(-14.3396)**	(-4.4222)**	(-1.8820)*	(-101.861)**	(-2.8111)**	(-2.7425)**
Soft drinks	-0.0960	-0.0514	0.0071	-1.1090	-0.0258	-0.0353	-0.0295	0.0077	-1.0865	-0.0107
	(-11.4457)**	(-10.5638)**	(2.8403)**	(-109.492)**	(-5.5747)**	(-2.3718)**	(-3.4669)**	(1.8279)*	(-63.7032)**	(-0.6830)
Coffee & tea	-0.1427	-0.0781	-0.0127	-0.1102	-1.0196	-0.0786	-0.0371	-0.0082	-0.0525	-1.0006
	(-8.0766)**	(-6.2662)**	(-5.5172)**	(-6.6366)**	(-174.808)**	(-4.8881)**	(-4.5569)**	(-3.3763)**	(-4.8330)**	(-47.7285)**

Table 5.6 Estimates of own- and cross-health information elasticities of the general beverage demand system, 1996 and 2001.

	Health information 1996					Health information 2001				
Quantity of	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks
Milk	0.0144	-0.0021	-0.0011	0.0032	0.0009	-0.0211	0.0003	-0.0054	-0.0016	0.0021
	(1.3866)	(-1.3938)	(-0.7936)	(2.2715)**	(0.6725)	(-1.3824)	(0.0998)	(-2.9702)**	(-0.6944)	(0.5412)
Fruit juice	-0.0053	-0.0018	-0.0014	0.0002	-0.0011	-0.0490	0.0025	0.0040	0.0041	-0.0001
	(-0.5344)	(-1.2250)	(-0.9732)	(0.1181)	(-0.8990)	(-2.8659)**	(0.6937)	(1.9939)**	(1.6404)*	(-0.0269)
Vegetable juice	-0.0063	-0.0009	0.0012	-0.0012	0.0009	0.0039	-0.0014	0.0013	-0.0007	0.0022
	(-0.9605)	(-0.9108)	(1.3238)	(-1.3483)	(1.0835)	(0.4468)	(-0.7696)	(1.2704)	(-0.5147)	(0.9908)
Soft drinks	-0.0015	0.0048	0.0043	-0.0020	-0.0009	0.1049	0.0035	-0.0035	-0.0042	-0.0094
	(-0.1418)	(3.1800)**	(2.8901)**	(-1.4184)	(-0.6945)	(4.4741)**	(0.7474)	(-1.3300)	(-1.2697)	(-1.6380)
Coffee & tea	0.0031	0.0003	0.0013	0.0005	-0.0003	0.0081	0.0026	-0.0029	-0.0011	-0.0021
	(0.7236)	(0.5082)	(2.1412)**	(0.8134)	(-0.4967)	(1.0823)	(1.6485)*	(-3.1644)**	(-0.9749)	(-1.0701)

Table 5.7 Estimates of own- and cross-advertising elasticities of the general beverage demand system, 1996 and 2001.

	1996		*2001*	
Quantity of	Generic milk advertising	Brand milk advertising	Generic milk advertising	Brand milk advertising
Milk	0.0430	0.2237	0.0448	-0.0746
	(3.1920)**	(6.6363)**	(2.5667)**	(-1.1189)
Fruit juice	0.0576	0.1938	0.0614	0.1501
	(3.9766)**	(4.7219)**	(3.2384)**	(1.8376)*
Vegetable juice	0.0576	0.2299	0.0770	0.1484
	(3.4701)**	(5.0344)**	(3.6400)**	(1.6808)*
Soft drinks	0.0413	0.1564	0.0893	0.0585
	(2.8536)**	(5.0006)**	(4.1561)**	(1.0026)
Coffee & tea	0.0531	0.1762	0.0880	0.0566
	(3.6552)**	(5.3837)**	(4.7357)**	(0.9836)

Table 5.8 Estimates of own- and cross-price elasticities of the general beverage demand system calculated for the Atlantic region, 1996 and 2001.

	1996					*2001*				
Quantity of	Milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea
Milk	-1.1386	-0.0648	0.0163	-0.0493	-0.0323	-1.1111	-0.0293	0.0152	-0.0274	-0.0080
	(-60.0675)**	(-6.6736)**	(2.2927)**	(-4.6853)**	(-4.6293)**	(-59.8836)**	(-3.5462)**	(3.1097)**	(-2.3392)**	(-0.5636)
Fruit juice	-0.1361	-1.0650	0.0163	-0.0505	-0.0328	-0.0927	-1.0971	0.0150	-0.0305	-0.0091
	(-11.0583)**	(-146.471)**	(46.0982)**	(-9.5149)**	(-14.0614)**	(-3.1684)**	(-25.2565)**	(22.1795)**	(-3.0371)**	(-2.4839)**
Vegetable juice	-0.1192	-0.0189	-0.9440	-0.0494	-0.0323	-0.0614	-0.0116	-0.9487	-0.0281	-0.0082
	(-14.4884)**	(-5.4833)**	(-107.356)**	(-9.5371)**	(-14.1941)**	(-4.5072)**	(-1.7685)*	(-100.511)**	(-3.0354)**	(-2.4360)**
Soft drinks	-0.1008	-0.0488	0.0081	-1.1081	-0.0181	-0.0399	-0.0280	0.0087	-1.0909	-0.0081
	(-11.3822)**	(-10.3628)**	(3.4215)**	(-112.193)**	(-3.9580)**	(-2.5756)**	(-3.4126)**	(2.0584)**	(-62.0207)**	(-0.5170)
Coffee & tea	-0.1430	-0.0708	-0.0101	-0.1052	-1.0108	-0.0851	-0.0355	-0.0074	-0.0576	-0.9966
	(-9.1456)**	(-7.1707)**	(-5.4294)**	(-7.7408)**	(-178.437)**	(-4.8974)**	(-4.5196)**	(-2.9505)**	(-4.8616)**	(-45.2131)**

Table 5.9 Estimates of own- and cross-health information elasticities of the general beverage demand system calculated for the Atlantic region, 1996 and 2001.

	Health information 1996					*Health information 2001*				
Quantity of	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks
Milk	-0.0054	0.0034	0.0009	-0.0027	-0.0039	-0.0128	-0.0068	-0.0034	-0.0016	0.0011
	(-0.2350)	(1.0423)	(0.2878)	(-0.8811)	(-1.3654)	(-0.4169)	(-1.0544)	(-0.9310)	(-0.3483)	(0.1467)
Fruit juice	-0.0314	0.0054	0.0013	-0.0075	-0.0074	-0.0408	-0.0066	0.0066	0.0042	-0.0013
	(-1.0908)	(1.3097)	(0.3308)	(-1.9485)*	(-2.0494)**	(-1.0602)	(-0.8131)	(1.4517)	(0.7338)	(-0.1311)
Vegetable juice	-0.0387	0.0082	0.0046	-0.0107	-0.0069	0.0167	-0.0128	0.0045	-0.0008	0.0009
	(-1.1351)	(1.6556)*	(0.9629)	(-2.3278)**	(-1.6152)	(0.3835)	(-1.3959)	(0.8754)	(-0.1215)	(0.0771)
Soft drinks	-0.0272	0.0120	0.0069	-0.0095	-0.0071	0.1193	-0.0055	-0.0011	-0.0044	-0.0110
	(-0.9509)	(2.8976)**	(1.7355)*	(-2.4956)**	(-1.9780)**	(2.7884)**	(-0.6297)	(-0.2326)	(-0.7210)	(-1.0259)
Coffee & tea	-0.0252	0.0082	0.0042	-0.0078	-0.0071	0.0195	-0.0072	-0.0002	-0.0012	-0.0034
	(-0.8517)	(1.9192)*	(1.0242)	(-1.9812)*	(-1.9067)	(0.5113)	(-0.8943)	(-0.0519)	(-0.2126)	(-0.3528)

Table 5.10 Estimates of own- and cross-advertising elasticities of the general beverage demand system calculated for the Atlantic region, 1996 and 2001.

	1996		*2001*	
Quantity of	Generic milk advertising	Brand milk advertising	Generic milk advertising	Brand milk advertising
Milk	0.0627	0.0034	0.0370	-0.0583
	(3.8013)**	(1.0423)	(1.8111)*	(-0.7593)
Fruit juice	0.0790	0.0054	0.0529	0.1738
	(4.4185)**	(1.3097)	(2.3265)**	(1.7795)*
Vegetable juice	0.0839	0.0082	0.0669	0.1782
	(3.9990)**	(1.6556)*	(2.5436)**	(1.6264)
Soft drinks	0.0622	0.0120	0.0817	0.0739
	(3.5140)**	(2.8976)**	(3.2585)**	(1.0469)
Coffee & tea	0.0756	0.0082	0.0796	0.0717
	(4.1385)**	(1.9192)*	(3.4652)**	(1.0243)

Table 5.11 Estimates of own- and cross-price elasticities of the general beverage demand system calculated for Quebec, 1996 and 2001.

	1996					2001				
Quantity of	Milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea
Milk	-1.1208	-0.0711	0.0084	-0.0454	-0.0379	-1.1035	-0.0336	0.0104	-0.0238	-0.0098
	(-65.3087)**	(-7.3274)**	(1.2635)	(-4.4793)**	(-5.4746)**	(-63.1758)**	(-3.7553)**	(2.0324)**	(-2.1597)**	(-0.6934)
Fruit juice	-0.1163	-1.0716	0.0082	-0.0464	-0.0385	-0.0801	-1.0984	0.0099	-0.0263	-0.0109
	(-11.0009)**	(-145.165)**	(9.2716)**	(-9.3267)**	(-13.9350)**	(-3.2450)**	(-27.8274)**	(5.9310)**	(-2.9086)**	(-2.7310)**
Vegetable juice	-0.1060	-0.0267	-0.9533	-0.0454	-0.0380	-0.0554	-0.0163	-0.9553	-0.0244	-0.0101
	(-15.0763)**	(-6.7439)**	(-112.539)**	(-9.3381)**	(-14.0475)**	(-4.5375)**	(-2.1807)**	(-99.7449)**	(-2.8869)**	(-2.6966)**
Soft drinks	-0.0844	-0.0556	0.0005	-1.1023	-0.0242	-0.0334	-0.0323	0.0042	-1.0867	-0.0098
	(-10.9685)**	(-10.9675)**	(0.2422)	(-118.554)**	(-5.2063)**	(-2.3177)**	(-3.6504)**	(0.9514)	(-63.3757)**	(-0.6315)
Coffee & tea	-0.1192	-0.0774	-0.0187	-0.0965	-1.0191	-0.0767	-0.0402	-0.0123	-0.0528	-0.9991
	(-9.6126)**	(-7.8359)**	(-8.1623)**	(-8.1717)**	(-200.847)**	(-4.8482)**	(-4.6951)**	(-4.2818)**	(-4.8193)**	(-46.7353)**

Table 5.12 Estimates of own- and cross-health information elasticities of the general beverage demand system calculated for Quebec, 1996 and 2001.

	Health information 1996					Health information 2001				
Quantity of	Milk positive	Milk negative	Fruit juice	Vege juice	Soft drinks	Milk positive	Milk negative	Fruit juice	Vege juice	Soft drinks
Milk	-0.0051	0.0034	0.0009	-0.0026	-0.0039	-0.0036	-0.0068	-0.0036	-0.0016	0.0012
	(-0.2221)	(1.0263)	(0.2799)	(-0.8580)	(-1.3549)	(-0.9733)	(-1.0433)	(-0.9733)	(-0.3574)	(0.1550)
Fruit juice	-0.0309	0.0055	0.0014	-0.0074	-0.0073	0.0063	-0.0066	0.0063	0.0038	-0.0013
	(-1.0890)	(1.3346)	(0.3468)	(-1.9602)**	(-2.0461)**	(1.4181)	(-0.8425)	(1.4181)	(0.6974)	(-0.1320)
Vegetable juice	-0.0385	0.0081	0.0045	-0.0106	-0.0069	0.0042	-0.0122	0.0042	-0.0007	0.0006
	(-1.1365)	(1.6592)*	(0.9597)	(-2.3258)**	(-1.6147)	(0.8587)	(-1.3859)	(0.8587)	(-0.1131)	(0.0608)
Soft drinks	-0.0272	0.0120	0.0069	-0.0096	-0.0071	-0.0011	-0.0056	-0.0011	-0.0043	-0.0107
	(-0.9507)	(2.9114)**	(1.7392)*	(-2.4962)**	(-1.9751)**	(-0.2170)	(-0.6438)	(-0.2170)	(-0.7100)	(-1.0206)
Coffee & tea	-0.0250	0.0081	0.0041	-0.0078	-0.0070	-0.0001	-0.0072	-0.0001	-0.0011	-0.0033
	(-0.8534)	(1.9192)*	(1.0204)	(-1.9839)**	(-1.9059)	(-0.0193)	(-0.9129)	(-0.0193)	(-0.2029)	(-0.3424)

Table 5.13 Estimates of own- and cross-advertising elasticities of the general beverage demand system calculated for Quebec, 1996 and 2001.

	1996		*2001*	
Quantity of	Generic milk advertising	Brand milk advertising	Generic milk advertising	Brand milk advertising
Milk	0.0627 (3.7896)**	0.1582 (3.7380)	0.0367 (1.7770)	-0.0617 (-0.7922)
Fruit juice	0.0777 (4.4257)**	0.1047 (2.0022)**	0.0525 (2.3605)**	0.1638 (1.7432)*
Vegetable juice	0.0835 (4.0258)**	0.1199 (1.9339)	0.0648 (2.5581)**	0.1626 (1.5719)
Soft drinks	0.0622 (3.5116)**	0.0857 (2.0586)**	0.0808 (3.2424)**	0.0730 (1.0367)
Coffee & tea	0.0748 (4.1443)**	0.0995 (2.3064)**	0.0776 (3.4244)**	0.0697 (0.9968)

Table 5.14 Estimates of own- and cross-price elasticities of the general beverage demand system calculated for Ontario, 1996 and 2001.

	1996					*2001*				
Quantity of	Milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea
Milk	-1.1230 (-68.3082)**	-0.0666 (-7.3939)**	0.0143 (2.2566)**	-0.0499 (-5.0478)**	-0.0389 (-5.8377)**	-1.1045 (-62.9779)**	-0.0332 (-3.7621)**	0.0143 (3.0193)**	-0.0263 (-2.3206)**	-0.0104 (-0.7455)
Fruit juice	-0.1186 (-11.4156)**	-1.0663 (-157.3600)**	0.0143 (37.5038)**	-0.0509 (-9.6707)**	-0.0394 (-13.8274)**	-0.0805 (-3.5193)**	-1.0918 (-32.4140)**	0.0141 (20.0810)**	-0.0287 (-3.0398)**	-0.0115 (-2.8251)**
Vegetable juice	-0.1077 (-14.6848)**	-0.0237 (-6.3695)**	-0.9491 (-121.7250)**	-0.0500 (-9.6836)**	-0.0390 (-13.9203)**	-0.0572 (-4.5336)**	-0.0160 (-2.1576)**	-0.9525 (-109.917)**	-0.0269 (-3.0189)**	-0.0107 (-2.7914)**
Soft drinks	-0.0884 (-11.1825)**	-0.0519 (-10.8829)**	0.0069 (3.1999)**	-1.1045 (-120.334)**	-0.0258 (-5.6961)**	-0.0355 (-2.4145)**	-0.0319 (-3.6463)**	0.0083 (1.9652)**	-1.0884 (-62.3558)**	-0.0104 (-0.6750)
Coffee & tea	-0.1207 (-10.2088)**	-0.0704 (-8.3390)**	-0.0097 (-6.3227)**	-0.0977 (-8.8800)**	-1.0217 (-221.581)**	-0.0780 (-4.8727)**	-0.0395 (-4.6972)**	-0.0073 (-3.1045)**	-0.0547 (-4.8532)**	-1.0003 (-48.4452)**

Table 5.15 Estimates of own- and cross-health information elasticities of the general beverage demand system calculated for Ontario, 1996 and 2001.

	Health information 1996					*Health information 2001*				
Quantity of	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks
Milk	-0.0049	0.0034	0.0009	-0.0026	-0.0039	-0.0133	-0.0068	-0.0035	-0.0016	0.0012
	(-0.2159)	(1.0183)	(0.2760)	(-0.8469)	(-1.3493)	(-0.4314)	(-1.0464)	(-0.9613)	(-0.3549)	(0.1527)
Fruit juice	-0.0310	0.0054	0.0013	-0.0074	-0.0073	-0.0377	-0.0066	0.0063	0.0039	-0.0013
	(-1.0901)	(1.3228)	(0.3392)	(-1.9538)*	(-2.0488)**	(-1.0043)	(-0.8349)	(1.4284)	(0.7067)	(-0.1318)
Vegetable juice	-0.0392	0.0082	0.0046	-0.0108	-0.0069	0.0163	-0.0125	0.0044	-0.0007	0.0008
	(-1.1408)	(1.6524)*	(0.9674)	(-2.3282)**	(-1.6079)	(0.3812)	(-1.3923)	(0.8688)	(-0.1179)	(0.0699)
Soft drinks	-0.0271	0.0119	0.0069	-0.0095	-0.0071	0.1103	-0.0057	-0.0009	-0.0041	-0.0101
	(-0.9514)	(2.9041)**	(1.7347)*	(-2.4927)**	(-1.9768)**	(2.7217)**	(-0.6720)	(-0.1853)	(-0.6865)	(-0.9890)
Coffee & tea	-0.0248	0.0081	0.0042	-0.0077	-0.0070	0.0187	-0.0072	-0.0001	-0.0011	-0.0033
	(-0.8510)	(1.9200)	(1.0268)	(-1.9803)**	(-1.9073)	(0.5008)	(-0.9149)	(-0.0160)	(-0.2020)	(-0.3415)

Table 5.16 Estimates of own- and cross-advertising elasticities of the general beverage demand system calculated for Ontario, 1996 and 2001.

	1996		*2001*	
Quantity of	Generic milk advertising	Brand milk advertising	Generic milk advertising	Brand milk advertising
Milk	0.0626	0.1585	0.0368	-0.0607
	(3.7834)**	(3.7518)**	(1.7899)*	(-0.7864)
Fruit juice	0.0779	0.1048	0.0522	0.1649
	(4.4352)**	(2.0033)**	(2.3461)**	(1.7445)*
Vegetable juice	0.0846	0.1214	0.0659	0.1710
	(4.0299)**	(1.9326)	(2.5598)**	(1.5956)
Soft drinks	0.0620	0.0855	0.0789	0.0711
	(3.5202)**	(2.0582)**	(3.2797)**	(1.0094)
Coffee & tea	0.0746	0.0990	0.0773	0.0694
	(4.1486)**	(2.3159)**	(3.4413)**	(0.9916)

Table 5.17 Estimates of own- and cross-price elasticities of the general beverage demand system calculated for the Prairie region, 1996 and 2001.

	1996					2001				
Quantity of	Milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea
Milk	-1.1368	-0.0616	0.0158	-0.0461	-0.0407	-1.1071	-0.0286	0.0144	-0.0280	-0.0111
	(-59.7411)**	(-6.3507)**	(2.1906)**	(-4.3751)**	(-5.5626)**	(-62.0037)**	(-3.5234)**	(3.0063)**	(-2.3907)**	(-0.7705)
Fruit juice	-0.1346	-1.0618	0.0157	-0.0473	-0.0414	-0.0875	-1.0958	0.0142	-0.0311	-0.0124
	(-10.8981)**	(-146.029)**	(38.0570)**	(-9.2963)**	(-14.0075)**	(-3.1357)**	(-25.4817)**	(17.9394)**	(-3.0727)**	(-2.8601)**
Vegetable juice	-0.1169	-0.0158	-0.9437	-0.0462	-0.0408	-0.0583	-0.0113	-0.9498	-0.0287	-0.0114
	(-14.5157)**	(-4.9669)**	(-104.535)**	(-9.3149)**	(-14.1468)**	(-4.5036)**	(-1.7536)*	(-101.422)**	(-3.0730)**	(-2.8427)**
Soft drinks	-0.0986	-0.0455	0.0076	-1.1063	-0.0263	-0.0365	-0.0273	0.0083	-1.0918	-0.0110
	(-11.2868)**	(-9.9586)**	(3.1232)**	(-111.128)**	(-5.3879)**	(-2.4239)**	(-3.3629)**	(1.9326)	(-61.0943)**	(-0.7005)
Coffee & tea	-0.1424	-0.0678	-0.0115	-0.1035	-1.0209	-0.0813	-0.0347	-0.0079	-0.0580	-1.0001
	(-8.8369)**	(-6.7758)**	(-5.5953)**	(-7.3845)**	(-180.399)**	(-4.8776)**	(-4.4889)**	(-3.1413)**	(-4.8709)**	(-45.7853)**

Table 5.18 Estimates of own- and cross-health information elasticities of the general beverage demand system calculated for the Prairie region, 1996 and 2001.

	1996					2001				
Quantity of	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks
Milk	-0.0053	0.0034	0.0009	-0.0027	-0.0039	-0.0128	-0.0068	-0.0034	-0.0016	0.0011
	(-0.2326)	(1.0396)	(0.2863)	(-0.8771)	(-1.3635)	(-0.4160)	(-1.0545)	(-0.9276)	(-0.3477)	(0.1465)
Fruit juice	-0.0316	0.0054	0.0013	-0.0075	-0.0074	-0.0399	-0.0066	0.0066	0.0041	-0.0013
	(-1.0915)	(1.3002)	(0.3246)	(-1.9440)*	(-2.0495)**	(-1.0417)	(-0.8198)	(1.4463)	(0.7268)	(-0.1313)
Vegetable juice	-0.0397	0.0083	0.0047	-0.0109	-0.0070	0.0167	-0.0128	0.0045	-0.0008	0.0009
	(-1.1397)	(1.6450)	(0.9728)	(-2.3366)**	(-1.6062)	(0.3841)	(-1.3945)	(0.8782)	(-0.1219)	(0.0778)
Soft drinks	-0.0272	0.0119	0.0069	-0.0095	-0.0071	0.1125	-0.0056	-0.0009	-0.0041	-0.0103
	(-0.9511)	(2.8882)**	(1.7361)*	(-2.4967)**	(-1.9790)**	(2.7475)**	(-0.6621)	(-0.1965)	(-0.6942)	(-1.0012)
Coffee & tea	-0.0254	0.0083	0.0043	-0.0079	-0.0071	0.0192	-0.0072	-0.0002	-0.0012	-0.0034
	(-0.8490)	(1.9195)	(1.0309)	(-1.9774)**	(-1.9070)	(0.5073)	(-0.9020)	(-0.0381)	(-0.2084)	(-0.3483)

Table 5.19 Estimates of own- and cross-advertising elasticities of the general beverage demand system calculated for the Prairie region, 1996 and 2001.

	1996		2001	
Quantity of	Generic milk advertising	Brand milk advertising	Generic milk advertising	Brand milk advertising
Milk	0.0627	0.1575	0.0370	-0.0582
	(3.8004)**	(3.7174)**	(1.8114)*	(-0.7575)
Fruit juice	0.0795	0.1069	0.0529	0.1716
	(4.4162)**	(1.9965)**	(2.3358)**	(1.7676)*
Vegetable juice	0.0856	0.1229	0.0670	0.1790
	(3.9848)**	(1.9335)	(2.5401)**	(1.6382)
Soft drinks	0.0622	0.0858	0.0796	0.0718
	(3.5151)**	(2.0558)**	(3.2554)**	(1.0182)
Coffee & tea	0.0763	0.1013	0.0788	0.0709
	(4.1387)**	(2.3219)**	(3.4474)**	(1.0117)

Table 5.20 Estimates of own- and cross-price elasticities of the general beverage demand system calculated for British Columbia, 1996 and 2001.

	1996					*2001.0000*				
Quantity of	Milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea
Milk	-1.1277	-0.0647	0.0164	-0.0406	-0.0509	-1.1129	-0.0319	0.0163	-0.0168	-0.0155
	(-63.4066)**	(-6.8110)**	(2.3661)**	(-4.0150)**	(-6.7956)**	(-59.6064)**	(-3.6373)**	(3.3801)**	(-1.6758)*	(-1.0291)
Fruit juice	-0.1243	-1.0648	0.0163	-0.0416	-0.0517	-0.1032	-1.1194	0.0161	-0.0198	-0.0177
	(-11.0219)**	(-149.136)**	(50.9909)**	(-8.9687)**	(-13.8796)**	(-2.5858)**	(-16.8507)**	(30.8985)**	(-2.4565)**	(-3.1187)**
Vegetable juice	-0.1105	-0.0196	-0.9445	-0.0406	-0.0510	-0.0627	-0.0138	-0.9442	-0.0174	-0.0159
	(-14.7294)**	(-5.6304)**	(-110.088)**	(-8.9749)**	(-13.9990)**	(-4.5195)**	(-1.9283)*	(-92.6570)**	(-2.4447)**	(-3.1973)**
Soft drinks	-0.0909	-0.0491	0.0084	-1.0987	-0.0369	-0.0402	-0.0305	0.0100	-1.0825	-0.0154
	(-11.1361)**	(-10.4233)**	(3.5923)**	(-118.736)**	(-7.1802)**	(-2.5394)**	(-3.5025)**	(2.2867)**	(-64.0807)**	(-0.9438)
Coffee & tea	-0.1289	-0.0702	-0.0094	-0.0924	-1.0348	-0.0883	-0.0390	-0.0068	-0.0470	-1.0040
	(-9.3635)**	(-7.3827)**	(-5.3257)**	(-7.8085)**	(-197.257)**	(-4.9002)**	(-4.5759)**	(-2.5666)**	(-4.6636)**	(-43.3135)**

Table 5.21 Estimates of own- and cross-health information elasticities of the general beverage demand system calculated for British Columbia, 1996 and 2001.

	Health information 1996					Health information 2001				
Quantity of	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks
Milk	-0.0047	0.0033	0.0009	-0.0025	-0.0039	-0.0127	-0.0068	-0.0034	-0.0016	0.0011
	(-0.2036)	(1.0029)	(0.2685)	(-0.8249)	(-1.3390)	(-0.4141)	(-1.0555)	(-0.9230)	(-0.3471)	(0.1457)
Fruit juice	-0.0312	0.0054	0.0013	-0.0075	-0.0073	-0.0405	-0.0068	0.0067	0.0041	-0.0013
	(-1.0904)	(1.3184)	(0.3366)	(-1.9530)*	(-2.0486)**	(-1.0350)	(-0.8225)	(1.4415)	(0.7225)	(-0.1314)
Vegetable juice	-0.0395	0.0083	0.0047	-0.0109	-0.0070	0.0169	-0.0129	0.0046	-0.0008	0.0009
	(-1.1424)	(1.6520)*	(0.9649)	(-2.3277)**	(-1.6033)	(0.3846)	(-1.3994)	(0.8804)	(-0.1227)	(0.0794)
Soft drinks	-0.0276	0.0124	0.0073	-0.0098	-0.0072	0.1236	-0.0054	-0.0013	-0.0046	-0.0113
	(-0.9468)	(2.9591)**	(1.7730)*	(-2.5026)**	(-1.9724)*	(2.8694)**	(-0.6099)	(-0.2525)	(-0.7350)	(-1.0446)
Coffee & tea	-0.0252	0.0082	0.0043	-0.0079	-0.0071	0.0198	-0.0072	-0.0003	-0.0012	-0.0035
	(-0.8474)	(1.9213)*	(1.0346)	(-1.9757)*	(-1.9080)	(0.5148)	(-0.8880)	(-0.0622)	(-0.2155)	(-0.3560)

Table 5.22 Estimates of own- and cross-advertising elasticities of the general beverage demand system calculated for British Columbia, 1996 and 2001.

	1996		2001	
Quantity of	Generic milk advertising	Brand milk advertising	Generic milk advertising	Brand milk advertising
Milk	0.0629	0.1603	-0.0127	-0.0068
	(3.7806)**	(3.7574)**	(-0.4141)	(-1.0555)
Fruit juice	0.0785	0.1056	-0.0405	-0.0068
	(4.4183)**	(1.9968)**	(-1.0350)	(-0.8225)
Vegetable juice	0.0851	0.1223	0.0169	-0.0129
	(4.0141)**	(1.9227)*	(0.3846)	(-1.3994)
Soft drinks	0.0626	0.0861	0.1236	-0.0054
	(3.4720)**	(2.0636)**	(2.8694)**	(-0.6099)
Coffee & tea	0.0761	0.1008	0.0198	-0.0072
	(4.1421)**	(2.3266)**	(0.5148)	(-0.8880)

Table 5.23 Estimates of own- and cross-price elasticities of the general beverage demand system calculated for high household income level, 1996 and 2001.

	1996					2001				
Quantity of	Milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea
Milk	-1.1962	-0.1356	-0.3169	-0.2194	-0.1343	-1.5673	0.2273	1.5101	0.5536	0.7681
	(-65.2535)**	(-9.9611)**	(-7.1172)**	(-9.1667)**	(-4.1951)**	(-0.6318)	(0.1829)	(0.1848)	(0.1737)	(0.1909)
Fruit juice	-0.8224	-1.6227	-0.3166	-0.2155	-0.1322	-0.3417	-1.1516	1.5089	0.5389	0.7620
	(-0.9360)	(-2.4461)**	(-582.322)**	(-32.9410)**	(-38.7122)**	(-1.2687)	(-12.1449)**	(2177.870)**	(61.6726)**	(208.793)**
Vegetable juice	-0.1681	-0.3584	-1.1402	-0.2192	-0.1341	0.1948	1.4749	-1.1141	0.5371	0.7612
	(-24.2014)**	(-88.0305)**	(-601.116)**	(-42.6631)**	(-50.0125)**	(16.2562)**	(179.561)**	(-386.065)**	(61.1990)**	(207.679)**
Soft drinks	-0.3648	-0.2475	-0.6468	-1.2613	-0.2771	0.2967	0.0719	0.4578	-1.4076	0.3250
	(-3.7939)**	(-3.7334)**	(-2.9735)**	(-23.5397)**	(-2.6312)**	(0.2373)	(0.1659)	(0.2606)	(-1.2700)	(0.2927)
Coffee & tea	-0.1141	-0.0752	-0.0343	-0.0969	-0.8292	-0.1162	-0.0722	-0.1135	-0.0802	-0.8286
	(-10.0674)**	(-10.0535)**	(-1.3566)	(-9.2844)**	(-20.1120)**	(-5.6495)**	(-5.7457)**	(-5.0967)**	(-5.7014)**	(-7.3483)**

Table 5.24 Estimates of own- and cross-health information elasticities of the general beverage demand system calculated for high household income level, 1996 and 2001.

	Health informaiton 1996					Health information 2001				
Quantity of	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks
Milk	0.0070	0.0014	-0.0001	0.0001	-0.0029	-0.0279	-0.0279	-0.0073	-0.0024	0.0027
	(0.2688)	(0.3800)	(-0.0297)	(0.0382)	(-0.8896)	(-0.7909)	(-0.7909)	(-1.2510)	(-0.5960)	(0.3796)
Fruit juice	-0.0333	0.0046	0.0007	-0.0073	-0.0078	-0.0522	-0.0522	0.0073	0.0050	-0.0012
	(-1.1027)	(1.0515)	(0.1713)	(-1.8156)	(-2.0428)**	(-1.3487)	(-1.3487)	(1.6125)	(0.8941)	(-0.1264)
Vegetable juice	0.0025	0.0031	-0.0010	-0.0003	-0.0029	-0.0049	-0.0049	-0.0019	0.0012	-0.0041
	(0.2146)	(1.8457)	(-0.6406)	(-0.2076)	(-1.9834)**	(-0.2932)	(-0.2932)	(-0.9156)	(0.4774)	(-0.9471)
Soft drinks	-0.0311	0.0160	0.0101	-0.0117	-0.0084	0.1561	0.1561	-0.0027	-0.0059	-0.0142
	(-0.9059)	(3.2205)*	(2.0888)**	(-2.5204)**	(-1.9436)*	(3.3740)**	(3.3740)**	(-0.4953)	(-0.9058)	(-1.2635)
Coffee & tea	-0.0231	0.0070	0.0032	-0.0070	-0.0061	0.0133	0.0133	0.0011	-0.0005	-0.0020
	(-0.9033)	(1.9005)	(0.8935)	(-2.0478)**	(-1.8877)*	(0.4077)	(0.4077)	(0.2809)	(-0.1138)	(-0.2459)

Table 5.25 Estimates of own- and cross-advertising elasticities of the general beverage demand system calculated for high household income level, 1996 and 2001.

	1996		2001	
Quantity of	Generic milk advertising	Brand milk advertising	Generic milk advertising	Brand milk advertising
Milk	0.0674	0.2153	0.0280	0.0120
	(3.3992)**	(4.4212)**	(1.3843)	(0.1198)
Fruit juice	0.0828	0.1092	0.1973	0.0484
	(4.2965)**	(1.9185)*	(2.0334)**	(2.1000)**
Vegetable juice	0.0165	0.0213	-0.1914	0.0168
	(2.2274)**	(0.9889)	(-4.0204)**	(1.5887)
Soft drinks	0.0665	0.0905	0.0783	0.0851
	(3.2085)**	(2.1418)**	(1.2936)	(2.0299)**
Coffee & tea	0.06493	0.0887	0.0536	0.0615
	(4.09417)**	(2.1270)**	(0.7579)	(3.1034)**

Table 5.26 Estimates of own- and cross-price elasticities of the general beverage demand system calculated for medium household income level, 1996 and 2001.

	1996					*2001*				
Quantity of	Milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea
Milk	-1.1961	-0.1293	-0.3210	-0.2234	-0.1460	-1.2767	0.0059	0.2328	0.0777	0.2044
	(-63.8635)**	(-9.4721)**	(-6.7653)**	(-8.8620)**	(-4.1462)**	(-5.4916)**	(0.0688)	(0.5585)	(0.4139)	(0.7318)
Fruit juice	-0.6567	-1.5036	-0.3206	-0.2190	-0.1439	-0.2709	-1.1114	0.2325	0.0740	0.2029
	(-1.1455)	(-3.3428)**	(-600.259)**	(-34.1551)**	(-45.4433)**	(-1.8552)*	(-23.0638)**	(295.401)**	(8.5310)**	(54.7620)**
Vegetable juice	-0.1705	-0.3575	-1.1394	-0.2231	-0.1459	-0.0248	0.2037	-1.1127	0.0720	0.2020
	(-23.3542)**	(-97.7818)**	(-582.763)**	(-41.7865)**	(-55.3487)**	(-1.9136)*	(28.4430)**	(-377.852)**	(8.1355)**	(53.4364)**
Soft drinks	-0.3774	-0.2498	-0.6793	-1.2505	-0.3200	0.0479	-0.0166	0.0763	-1.2405	0.1410
	(-3.3617)**	(-3.2074)**	(-2.6092)**	(-23.1029)**	(-2.3294)**	(0.2491)	(-0.2676)	(0.3179)	(-5.5660)**	(0.6822)
Coffee & tea	-0.1258	-0.0740	-0.0364	-0.1069	-0.7761	-0.1346	-0.0740	-0.1383	-0.0891	-0.7922
	(-10.8907)**	(-9.8034)**	(-1.2781)	(-10.1808)**	(-13.4477)**	(-5.2806)**	(-5.6196)**	(-5.8388)**	(-5.3337)**	(-5.9716)**

Table 5.27 Estimates of own- and cross-health information elasticities of the general beverage demand system calculated for medium household income level, 1996 and 2001.

	Health information 1996					*Health information 2001*				
Quantity of	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks
Milk	0.0058	0.0017	0.0000	-0.0002	-0.0030	-0.0245	-0.0023	-0.0064	-0.0023	0.0023
	(0.2235)	(0.4423)	(-0.5639)	(-0.0458)	(-0.9371)	(-0.7628)	(-0.4990)	(-1.6526)*	(-0.4990)	(0.2879)
Fruit juice	-0.0341	0.0045	0.0006	-0.0074	-0.0079	-0.0557	0.0053	0.0077	0.0053	-0.0013
	(-1.1031)	(1.0119)	(0.1470)	(-1.7922)*	(-2.0433)**	(-1.4045)	(0.9240)	(1.6421)*	(0.9240)	(-0.1252)
Vegetable juice	0.0025	0.0031	-0.0010	-0.0003	-0.0030	-0.0068	0.0014	-0.0024	0.0014	-0.0045
	(0.2109)	(1.8492)*	(-0.6366)	(-0.2156)	(-1.9863)**	(-0.3767)	(0.5101)	(-1.1014)	(0.5101)	(-0.9780)
Soft drinks	-0.0316	0.0163	0.0103	-0.0119	-0.0085	0.1577	-0.0059	-0.0025	-0.0059	-0.0144
	(-0.9041)	(3.2273)**	(2.0994)**	(-2.5139)**	(-1.9427)*	(3.2434)**	(-0.8703)	(-0.4513)	(-0.8703)	(-1.2123)
Coffee & tea	-0.0234	0.0072	0.0033	-0.0071	-0.0062	0.0136	-0.0006	0.0010	-0.0006	-0.0021
	(-0.9010)	(1.9006)*	(0.8994)	(-2.0437)**	(-1.8878)*	(0.4133)	(-0.1191)	(0.2632)	(-0.1191)	(-0.2516)

Table 5.28 Estimates of own- and cross-advertising elasticities of the general beverage demand system calculated for medium household income level, 1996 and 2001.

	1996		2001	
Quantity of	Generic milk advertising	Brand milk advertising	Generic milk advertising	Brand milk advertising
Milk	0.0674	0.2109	0.0260	0.0260
	(3.4340)**	(4.3930)**	(1.1836)	(1.1836)
Fruit juice	0.0849	0.1117	0.0486	0.0486
	(4.3201)**	(1.9189)*	(2.0593)**	(2.0593)**
Vegetable juice	0.0167	0.0216	0.0126	0.0126
	(2.2432)**	(0.9949)	(1.0946)	(1.0946)
Soft drinks	0.0674	0.0918	0.0899	0.0899
	(3.2069)**	(2.1542)**	(3.0489)**	(3.0489)**
Coffee & tea	0.0661	0.0902	0.0626	0.0626
	(4.0871)**	(2.1331)**	(3.1067)**	(3.1067)**

Table 5.29 Estimates of own- and cross-price elasticities of the general beverage demand system calculated for low household income level, 1996 and 2001.

Quantity of	*1996* Milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	*2001* Milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea
Milk	-1.1920	-0.1191	-0.3333	-0.2241	-0.1916	-1.2297	-0.0345	0.0268	0.0032	0.1106
	(-59.2637)**	(-8.3019)**	(-5.5282)**	(-7.0477)**	(-3.7162)**	(-14.3919)**	(-1.4069)	(0.2738)	(0.0624)	(1.2960)
Fruit juice	-0.4005	-1.3167	-0.3328	-0.2190	-0.1883	-0.2151	-1.0789	0.0266	0.0014	0.1096
	(-1.8193)*	(-6.5720)**	(-651.503)**	(-41.4108)**	(-55.9084)**	(-2.7880)**	(-40.1561)**	(28.9667)**	(0.1693)	(26.0441)**
Vegetable juice	-0.1760	-0.3655	-1.1341	-0.2234	-0.1912	-0.0685	0.0008	-1.1095	-0.0009	0.1085
	(-21.1407)**	(-111.235)**	(-505.551)**	(-47.6923)**	(-64.0538)**	(-5.0905)**	(0.1217)	(-348.255)**	(-0.1002)	(24.8515)**
Soft drinks	-0.4275	-0.2733	-0.8293	-1.2008	-0.5138	-0.0246	-0.0413	-0.0352	-1.1896	0.0848
	(-2.0971)**	(-1.9354)*	(-1.6004)	(-22.1166)**	(-1.4495)	(-0.3784)	(-1.7916)*	(-0.4581)	(-13.3018)**	(1.0687)
Coffee & tea	-0.1770	-0.0902	-0.0445	-0.1277	-0.5293	-0.1566	-0.0815	-0.1742	-0.0997	-0.7379
	(-12.5118)**	(-10.9027)**	(-1.0306)	(-12.3565)**	(-3.0068)**	(-4.6119)**	(-4.9949)**	(-5.0746)**	(-4.6626)**	(-4.5028)**

Table 5.30 Estimates of own- and cross-health information elasticities of the general beverage demand system calculated for low household income level, 1996 and 2001.

Quantity of	*Health information 1996* Milk positive	Milk negative	Fruit juice	Vege juice	Soft drinks	*Health information 2001* Milk positive	Milk negative	Fruit juice	Vege juice	Soft drinks
Milk	0.0033	0.0021	0.0002	-0.0008	-0.0033	-0.0304	0.0011	-0.0079	-0.0022	0.0030
	(0.1291)	(0.5695)	(0.0597)	(-0.2189)	(-1.0327)	(-1.4019)	(0.2473)	(-2.9819)**	(-0.6889)	(0.5527)
Fruit juice	-0.0358	0.0044	0.0005	-0.0075	-0.0083	-0.0707	0.0023	0.0062	0.0060	-0.0003
	(-1.1025)	(0.9335)	(0.0999)	(-1.7464)*	(-2.0384)**	(-2.7136)**	(0.4329)	(2.0651)**	(1.5996)	(-0.0535)
Vegetable juice	0.0059	0.0028	-0.0015	0.0005	-0.0027	-0.0169	0.0105	-0.0050	0.0015	-0.0038
	(0.4904)	(1.6053)	(-0.9129)	(0.3047)	(-1.7836)*	(-0.4931)	(1.4481)	(-1.2187)	(0.3047)	(-0.4421)
Soft drinks	-0.0339	0.0179	0.0114	-0.0129	-0.0092	0.1619	0.0031	-0.0047	-0.0064	-0.0146
	(-0.8945)	(3.2499)**	(2.1442)**	(-2.4621)**	(-1.9317)*	(4.1516)**	(0.4145)	(-1.1314)	(-1.2270)	(-1.6035)
Coffee & tea	-0.0249	0.0076	0.0035	-0.0076	-0.0066	0.0056	0.0003	-0.0012	-0.0006	-0.0013
	(-0.8944)	(1.8886)*	(0.9111)	(-2.0183)**	(-1.8761)*	(0.9603)	(0.2456)	(-1.7701)*	(-0.6885)	(-0.8469)

Table 5.31 Estimates of own- and cross-advertising elasticities of the general beverage demand system calculated for low household income level, 1996 and 2001.

	1996		*2001*	
Quantity of	Generic milk advertising	Brand milk advertising	Generic milk advertising	Brand milk advertising
Milk	0.0681 (3.4872)**	0.2039 (4.3313)**	0.0290 (1.3427)	-0.1034 (-1.2881)
Fruit juice	0.0888 (4.3246)**	0.1161 (1.9033)*	0.0489 (1.9826)*	0.2245 (2.1609)**
Vegetable juice	0.0115 (1.4924)	0.0139 (0.6247)	0.0100 (0.8094)	-0.2472 (-4.3567)**
Soft drinks	0.0717 (3.1790)**	0.0973 (2.2236)**	0.0950 (3.1147)**	0.0873 (1.3065)
Coffee & tea	0.0705 (3.9558)**	0.0960 (2.1267)**	0.0643 (3.0972)**	0.0564 (0.7933)

Table 5.32 Estimates of own- and cross-price elasticities of the general beverage demand system calculated for couple with children type of households, 1996 and 2001.

	1996					*2001*				
Quantity of	Milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea
Milk	-1.2009 (-65.3561)**	-0.1317 (-9.8247)**	-0.3178 (-7.0967)**	-0.2223 (-9.2604)**	-0.1338 (-4.0997)**	-1.8425 (-0.2875)	0.4379 (0.1237)	2.6185 (0.1142)	0.9598 (0.1097)	1.2698 (0.1165)
Fruit juice	-0.7380 (-1.0677)	-1.5659 (-2.9021)**	-0.3175 (-751.387)**	-0.2184 (-34.1290)**	-0.1320 (-46.3778)**	-0.3472 (-1.2738)	-1.1551 (-11.3199)**	2.6168 (4370.990)**	0.9337 (100.4870)**	1.2611 (405.784)**
Vegetable juice	-0.1734 (-23.2827)**	-0.3566 (-94.6758)**	-1.1404 (-588.685)**	-0.2220 (-41.5429)**	-0.1336 (-56.2118)**	0.3918 (30.7571)**	2.5855 (343.690)**	-1.1148 (-379.349)**	0.9319 (99.8638)**	1.2604 (403.871)**
Soft drinks	-0.3679 (-3.8437)**	-0.2453 (-3.6380)**	-0.6483 (-2.9416)**	-1.2591 (-24.2463)**	-0.2816 (-2.5685)**	0.3777 (0.2047)	0.1098 (0.1667)	0.5922 (0.2237)	-1.4720 (-0.9294)	0.3945 (0.2456)
Coffee & tea	-0.1231 (-10.5858)**	-0.0720 (-9.5199)**	-0.0341 (-1.2958)	-0.1017 (-9.5867)**	-0.8124 (-17.9396)**	-0.1193 (-5.6762)**	-0.0681 (-5.7429)**	-0.1115 (-4.9263)**	-0.0825 (-5.7180)**	-0.8289 (-7.4165)**

Table 5.33 Estimates of own- and cross-health information elasticities of the general beverage demand system calculated for couple with children type of households, 1996 and 2001.

	Health information 1996					*Health information 2001*				
Quantity of	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks
Milk	0.0065	0.0015	-0.0001	0.0000	-0.0030	-0.0226	-0.0059	-0.0059	-0.0022	0.0021
	(0.2487)	(0.4077)	(-0.0168)	(0.0010)	(-0.9107)	(-0.7008)	(-0.8695)	(-1.5327)	(-0.4716)	(0.2610)
Fruit juice	-0.0345	0.0045	0.0006	-0.0074	-0.0080	-0.0589	-0.0052	0.0079	0.0056	-0.0013
	(-1.1029)	(0.9983)	(0.1388)	(-1.7828)*	(-2.0429)**	(-1.4520)	(-0.6195)	(1.6672)*	(0.9498)	(-0.1242)
Vegetable juice	-0.0002	0.0035	-0.0007	-0.0010	-0.0032	-0.0109	0.0044	-0.0036	0.0017	-0.0055
	(-0.0153)	(1.9832)**	(-0.4008)	(-0.6203)	(-2.0870)**	(-0.4754)	(0.8741)	(-1.2958)	(0.5177)	(-0.9412)
Soft drinks	-0.0312	0.0161	0.0102	-0.0118	-0.0084	0.1687	-0.0041	-0.0027	-0.0064	-0.0154
	(-0.9049)	(3.2234)**	(2.0959)**	(-2.5202)**	(-1.9436)*	(3.2820)**	(-0.3958)	(-0.4717)	(-0.8837)	(-1.2260)
Coffee & tea	-0.0232	0.0071	0.0032	-0.0071	-0.0061	0.0141	-0.0074	0.0009	-0.0006	-0.0022
	(-0.9017)	(1.9012)	(0.8979)	(-2.0457)**	(-1.8884)*	(0.4214)	(-1.0509)	(0.2372)	(-0.1268)	(-0.2600)

Table 5.34 Estimates of own- and cross-advertising elasticities of the general beverage demand system calculated for couple with children type of households, 1996 and 2001.

	1996		2001	
Quantity of	Generic milk advertising	Brand milk advertising	Generic milk advertising	Brand milk advertising
Milk	0.0673	0.2130	0.0226	-0.1033
	(3.4159)**	(4.4095)**	(2.7008)**	(-1.2879)
Fruit juice	0.0859	0.1128	-0.0589	0.2151
	(4.3262)**	(1.9205)**	(-1.4520)	(2.1232)**
Vegetable juice	0.0210	0.0279	-0.0109	-0.2947
	(2.7788)**	(1.2585)	(-0.4754)	(-4.2395)**
Soft drinks	0.0667	0.0909	0.1687	0.0869
	(3.2086)**	(2.1446)**	(3.2820)**	(1.3021)
Coffee & tea	0.0653	0.0891	0.0141	0.0560
	(4.0957)**	(2.1325)**	(0.4214)	(0.7874)

Table 5.35 Estimates of own- and cross-price elasticities of the general beverage demand system calculated for other households, 1996 and 2001.

	1996					*2001*				
Quantity of	Milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea
Milk	-1.1898	-0.1210	-0.3322	-0.2242	-0.1883	-1.2286	-0.0353	0.0302	0.0053	0.1113
	(-59.3885)**	(-8.4329)**	(-5.6199)**	(-7.1972)**	(-3.7866)**	(-14.0937)**	(-1.4066)	(0.2999)	(0.0996)	(1.2727)
Fruit juice	-0.4223	-1.3301	-0.3317	-0.2189	-0.1850	-0.2165	-1.0802	0.03	0.0035	0.1104
	(-1.6834)*	(-6.1217)**	(-578.841)**	(-39.9845)**	(-53.0965)**	(-2.7113)**	(-39.8685)**	(31.8331)**	(0.4280)	(25.522)**
Vegetable juice	-0.1724	-0.3653	-1.1346	-0.2235	-0.1879	-0.0667	0.0031	-1.1095	0.0013	0.1092
	(-21.6429)**	(-107.104)**	(-515.206)**	(-46.7316)**	(-61.7425)**	(-5.0695)**	(0.4441)	(-351.482)**	(0.1502)	(24.363)**
Soft drinks	-0.4235	-0.2713	-0.8157	-1.2061	-0.4946	-0.0218	-0.0422	-0.033	-1.1896	0.0851
	(-2.1505)**	(-2.0263)**	(-1.6650)*	(-21.7860)**	(-1.5113)	(-0.3267)	(-1.7992)*	(-0.4197)	(-13.0399)**	(1.0504)
Coffee & tea	-0.1657	-0.0898	-0.0440	-0.1256	-0.5624	-0.1539	-0.0827	-0.1726	-0.0982	-0.7420
	(-12.8039)**	(-11.1301)**	(-1.0702)	(-12.3339)**	(-3.5824)**	(-4.6504)**	(-5.0281)**	(-5.1219)**	(-4.7029)**	(-4.6015)**

Table 5.36 Estimates of own- and cross-health information elasticities of the general beverage demand system calculated for other households, 1996 and 2001.

	Health information 1996					Health information 2001				
Quantity of	Milk positive	Milk negative	Fruit juice	Vege juice	Soft drinks	Milk positive	Milk negative	Fruit juice	Vege juice	Soft drinks
Milk	0.0037	0.0020	0.0002	-0.0007	-0.0033	-0.0306	-0.0013	-0.0079	-0.0024	0.0030
	(0.1446)	(0.5487)	(0.0498)	(-0.1905)	(-1.0173)	(-0.5249)	(-0.0306)	(-0.6306)	(-0.6627)	(0.3720)
Fruit juice	-0.0350	0.0044	0.0005	-0.0075	-0.0081	-0.0556	-0.0053	0.0076	0.0053	-0.0013
	(-1.1031)	(0.9681)	(0.1205)	(-1.7680)*	(-2.0412)**	(-1.4019)	(-0.6451)	(1.6393)	(0.9231)	(-0.1253)
Vegetable juice	0.0078	0.0026	-0.0018	0.0010	-0.0025	-0.0031	-0.0004	-0.0013	0.0010	-0.0037
	(0.6316)	(1.4420)	(-1.0471)	(0.5812)	(-1.6401)*	(-0.1880)	(-0.1178)	(-0.6680)	(0.4189)	(-0.8685)
Soft drinks	-0.0335	0.0176	0.0112	-0.0127	-0.0091	0.1502	-0.0032	-0.0026	-0.0057	-0.0137
	(-0.8972)	(3.2422)**	(2.1305)**	(-2.4686)**	(-1.9346)*	(3.4014)**	(-0.2689)	(-0.4829)	(-0.9085)	(-1.2716)
Coffee & tea	-0.0248	0.0076	0.0035	-0.0076	-0.0066	0.0133	-0.0074	0.0011	-0.0006	-0.0021
	(-0.8957)	(1.8890)*	(0.9079)	(-2.0211)**	(-1.8765)*	(0.4087)	(-1.0778)	(0.2775)	(-0.1148)	(-0.2470)

Table 5.37 Estimates of own- and cross-advertising elasticities of the general beverage demand system calculated for other households, 1996 and 2001.

	1996		*2001*	
Quantity of	Generic milk advertising	Brand milk advertising	Generic milk advertising	Brand milk advertising
Milk	0.0681 (3.4777)**	0.2054 (4.3447)**	0.0003 (2.0010)**	-0.1408 (-0.6632)
Fruit juice	0.0869 (4.3249)**	0.1139 (1.9087)	0.0485 (2.0600)**	0.2063 (2.0708)**
Vegetable juice	0.0084 (1.0613)	0.0094 (0.4135)	0.0211 (2.0698)**	-0.1597 (-3.5920)**
Soft drinks	0.0711 (3.1925)**	0.0966 (2.2142)**	0.0814 (1.5668)	0.0752 (1.2007)
Coffee & tea	0.0701 (3.9634)**	0.0955 (2.1241)**	0.0616 (3.1098)**	0.0538 (0.7603)

Table 5.38 Estimated coefficients at the second stage of the bloskwise dependent beverage demand system, 1996 and 2001.

1996				*Price*				
	Whole milk	2% milk	Other milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	General milk
Whole milk	-0.0498	0.0330	0.0441	-0.0115	0.0215	-0.0208	-0.0166	
	(-5.7620)**	(5.8053)**	(7.1700)**	(-2.5647)**	(3.2608)**	(-5.8997)**	(-4.3091)**	
2% milk		-0.0996	0.0712	-0.0246	0.0918	-0.0494	-0.0224	
		(-11.475)**	(10.9124)**	(-3.7930)**	(10.7900)**	(-9.4707)**	(-3.9232)**	
Other milk			-0.1168	0.0009	-0.0452	0.0270	0.0188	
			(-13.282)**	(0.1590)	(-5.7053)**	(5.9381)**	(3.8158)**	
Fruit juice				-0.0037	0.0160	0.0004	0.0218	-0.0344
				(-0.6930)	(7.5664)**	(0.0951)	(4.7698)**	(-6.3098)**
Vegetable juice					-0.0541	0.0134	0.0140	0.0106
					(-17.789)**	(7.8924)**	(7.5549)**	(4.2639)**
Soft drinks						-0.0329	0.0178	0.0013
						(-6.2901)**	(3.3613)**	(0.2138)
Coffee & tea							-0.0760	0.0225
							(-6.9148)**	(3.1029)**

2001				*Price*				
	Whole milk	2% milk	Other milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	General milk
Whole milk	-0.0964	0.0735	0.0398	-0.0088	0.0096	-0.0073	-0.0104	
	(-6.2428)**	(7.2307)**	(3.7021)**	(-1.2714)	(1.0152)	(-1.4844)	(-1.9346)	
2% milk		-0.1869	0.1042	-0.0152	0.0694	-0.0256	-0.0193	
		(-12.437)**	(8.9152)**	(-1.5577)	(5.7841)**	(-3.6248)**	(-2.4880)**	
Other milk			-0.1822	0.0022	-0.0232	0.0271	0.0322	
			(-11.871)**	(0.2332)	(-1.9926)**	(4.0116)**	(4.3634)**	
Fruit juice				-0.0197	0.0189	0.0115	0.0082	-0.0189
				(-2.1619)**	(5.5882)**	(1.9992)**	(1.1470)	(-2.0485)**
Vegetable juice					-0.0834	0.0155	0.0151	0.0339
					(-18.420)**	(6.3524)**	(5.6339)**	(8.2735)**
Soft drinks						-0.0459	0.0221	-0.0032
						(-6.2017)**	(2.8401)**	(-0.3468)
Coffee & tea							-0.0479	-0.0118
							(-7.6706)**	(-1.0342)

Table 5.38 Estimated coefficients at the second stage of the bloskwise dependent beverage demand system, 1996 and 2001 (continuation).

1996	*Health Information*					*Advertising*	
	Positive milk	Negative milk	Fruit juice	Vege juice	Soft drinks	Generic	Brand
Whole milk	-0.0107	0.0011	-0.0001	-0.0006	-0.0004	-0.0004	-0.0025
	(-2.2579)**	(1.6490)*	(-0.1489)	(-1.0143)	(-0.6334)	(-0.1426)	(-0.2864)
2% milk	-0.0083	-0.0010	0.0035	-0.0002	0.0001	0.0151	0.0515
	(-1.1573)	(-0.9843)	(3.4855)**	(-0.1791)	(0.1408)	(3.3722)**	(3.8788)**
Other milk	0.0249	-0.0015	-0.0037	0.0030	0.0010	-0.0151	-0.0194
	(4.0461)**	(-1.6609)*	(-4.3212)**	(3.6753)**	(1.2989)	(-3.7332)**	(-1.6293)
Fruit juice	-0.0006	-0.0012	-0.0010	0.0001	-0.0008	0.0102	0.0300
	(-0.1032)	(-1.3474)	(-1.1490)	(0.1198)	(-1.0030)	(2.5632)**	(2.5409)**
Vegetable juice	-0.0025	-0.0002	0.0004	-0.0005	0.0002	-0.0001	-0.0004
	(-1.0557)	(-0.5819)	(1.1892)	(-1.5375)	(0.7748)	(-0.0978)	(-0.1001)
Soft drinks	0.0001	0.0033	0.0027	-0.0013	-0.0006	0.0255	-0.0024
	(0.0141)	(3.1198)**	(2.6568)**	(-1.3572)	(-0.6283)	(1.8673)*	(-13.9517)**
Coffee & tea	-0.0029	-0.0055	-0.0253	-0.0005	0.0004	-0.0082	-0.0846
	(-0.4982)	(-3.9217)**	(-2.8078)**	(-0.6376)	(0.5086)	(-2.1805)**	(-7.5648)**
2001	*Health Information*					*Advertising*	
	Positive milk	Negative milk	Fruit juice	Vege juice	Soft drinks	Generic	Brand
Whole milk	0.0041	-0.0083	-0.0005	0.0004	-0.0006	-0.0047	0.0280
	(0.6624)	(-1.3411)	(-0.7538)	(0.4114)	(-0.5646)	(-1.3502)	(1.7945)*
2% milk	0.0141	-0.0126	-0.0012	-0.0029	0.0001	0.0208	0.0271
	(1.4801)	(-1.3419)	(-1.0563)	(-2.1784)**	(0.0554)	(3.8861)**	(1.1375)
Other milk	-0.0300	0.0315	-0.0018	0.0024	0.0010	-0.0081	-0.1228
	(-3.2627)**	(3.4772)**	(-1.6880)*	(1.8547)*	(0.6957)	(-1.5815)	(-5.3700)**
Fruit juice	-0.0261	-0.0007	0.0021	0.0022	0.0011	-0.0016	0.0656
	(-2.9885)**	(-0.0801)	(2.0913)**	(1.8097)*	(0.8053)	(-0.3311)	(3.0114)**
Vegetable juice	0.0008	0.0021	0.0001	-0.0002	0.0003	-0.0025	0.0425
	(0.2508)	(0.6531)	(0.3343)	(-0.4966)	(0.6480)	(-1.3594)	(5.2565)**
Soft drinks	0.0411	-0.0049	-0.0010	-0.0015	-0.0020	0.0080	-0.0499
	(4.1977)**	(-0.5077)	(-0.8977)	(-1.1394)	(-1.2336)	(1.4591)	(-2.0434)**
Coffee & tea	-0.0041	0.0256	0.0159	-0.0003	-0.0001	-0.0118	0.0095
	(-0.5699)	(2.3992)**	(1.3240)	(-0.2566)	(-0.0607)	(-2.9112)**	(0.5269)

Table 5.38 Estimated coefficients at the second stage of the bloskwise dependent beverage demand system, 1996 and 2001 (continuation).

1996	*Demographics*					*Expenditure*	*Constant*
	Age	Gender	CC	Urbanity	income		
Whole milk	0.00001	0.0159	0.0436	-0.0046	-0.0141	-0.0533	0.2815
	(-0.0911)	(4.8243)**	(11.7307)**	(-1.9969)**	(-3.0141)**	(-26.1713)**	(2.8950)**
2% milk	0.0009	0.0079	0.0680	-0.0010	-0.0192	-0.1318	-0.2026
	(5.1444)**	(1.5771)	(12.0887)**	(-0.2872)	(-2.7099)**	(-42.8698)**	-1.3780
Other milk	-0.0005	-0.0243	-0.0645	-0.0003	0.0161	0.0845	0.2771
	(-2.9484)**	(-5.2219)**	(-12.3684)**	(-0.0829)	(2.4438)**	(31.7995)**	(2.0621)**
Fruit juice	0.0002	-0.0040	0.0505	0.0416	0.0183	-0.0787	-0.3621
	(1.3905)	(-0.8804)	(9.8400)**	(13.1198)**	(2.8214)**	(-30.5253)**	(-2.7285)**
Vegetable juice	0.0002	0.0040	-0.0136	-0.0033	-0.0042	0.0202	0.0072
	(3.1939)**	(2.4884)**	(-7.4651)**	(-2.9141)**	(-1.8080)*	(20.3432)**	0.1502
Soft drinks	-0.0024	0.0209	0.0161	0.0126	-0.0022	-0.0227	0.1110
	(-13.9517)**	(4.0643)**	(2.7686)**	(3.5188)**	(-0.2953)	(-7.3714)**	0.7325
Coffee & tea	0.0052	-0.0999	-0.0451	-0.0082	-0.0846	0.1818	0.8879
	(0.8462)	(-20.6174)**	(-15.0394)**	(-2.1805)**	(-7.5648)**	(72.6990)**	(7.0555)**
2001	*Demographics*					*Expenditure*	*Constant*
	Age	Gender	CC	Urbanity	Income		
Whole milk	0.0001	0.0116	0.0516	-0.0090	-0.0154	-0.0465	-0.0873
	(0.5088)	(2.4440)**	(9.2443)**	(-2.5551)**	(-2.4503)**	(-17.0102)**	(-0.4660)
2% milk	0.0007	-0.0006	0.0917	-0.0038	-0.0209	-0.1335	-0.1315
	(3.0590)**	(-0.0866)	(10.7641)**	(-0.7122)	(-2.1721)**	(-33.2581)**	(-0.4602)
Other milk	0.0005	-0.0194	-0.0607	0.0216	0.0244	0.0601	1.6535
	(1.9914)**	(-2.7817)**	(-7.4126)**	(4.1920)**	(2.6313)**	(15.7525)**	(6.0176)**
Fruit juice	-0.0001	-0.0062	0.0113	0.0247	0.0261	-0.0067	-0.6982
	(-0.4998)	(-0.9385)	(1.4461)	(5.0471)**	(2.9587)**	(-1.7838)*	(-2.6664)**
Vegetable juice	0.0001	-0.0020	-0.0201	-0.0051	-0.0027	0.0262	-0.5720
	(1.1730)	(-0.8180)	(-6.9334)**	(-2.7811)**	(-0.8348)	(19.0223)**	(-5.8733)**
Soft drinks	-0.0027	0.0099	-0.0321	-0.0190	-0.0228	0.0638	0.7857
	(-10.8464)**	(1.3388)	(-3.6622)**	(-3.4534)**	(-2.3009)**	(15.1513)**	(2.6777)**
Coffee & tea	0.0014	0.0067	-0.0417	-0.0095	0.0113	0.0498	0.0366
	(7.7575)**	(1.2180)	(-6.4295)**	(-2.3392)**	(1.5493)	(0.2285)	(11.4807)**

Table 5.39 The first stage coefficient estimates of the blockwise dependent beverage demand system, 1996 and 2001.

	1996		2001	
Parameter	Estimate	t-statistic	Estimate	t-statistic
Constant	-1.1646	(-3.0948)**	0.5980	(0.6773)
Price index	-0.1186	(-6.3925)**	-0.2060	(-6.2444)**
Generic milk advertising	0.0380	(3.6327)**	0.0558	(3.3664)**
Brand milk advertising	0.1470	(5.1627)**	0.0429	(0.5829)
Age	0.0018	(3.6032)**	-0.0008	(-1.0694)
Gender (male)	0.0499	(3.3580)**	0.0224	(0.9944)
Household with children	0.4440	(27.3493)**	0.4774	(18.6108)**
Income	0.2429	(23.9464)**	0.2419	(14.8187)**
Urbanity	-0.0663	(-3.1325)**	-0.1172	(-3.9214)**

Table 5.40 Estimates of own- and cross-price elasticities of the blockwise dependent beverage demand system, 1996 and 2001.

Price 1996

Quantity of	Whole milk	2% milk	Other milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk
Whole milk	-1.7508	0.7069	0.8142	-0.0334	0.3767	-0.1209	-0.1491	
	(-12.5348)**	(7.7145)**	(8.1880)**	(-0.4632)	(3.5301)**	(-2.1583)**	(-2.4198)**	
2% milk	0.2248	-1.3537	0.4200	-0.0097	0.5719	-0.0865	-0.0188	
	(8.0962)**	(-32.5254)**	(13.3769)**	(-0.3113)	(12.2021)**	(-3.4923)**	(-0.6944)	
Other milk	0.2796	0.4118	-2.0532	-0.1384	-0.4499	0.0235	0.0310	
	(5.5624)**	(7.7979)**	(-28.7571)**	(-3.0160)**	(-6.7981)**	(0.6516)	(0.7853)	
Fruit juice				-0.9540	0.1506	0.0980	0.1717	-0.0356
				(-31.9389)**	(10.2307)**	(4.6925)**	(6.8417)**	(-1.1480)
Vegetable juice				0.5376	-3.3951	0.3588	0.4832	0.1142
				(5.7863)**	(-25.4316)**	(4.8776)**	(5.9960)**	(1.0370)
Soft drinks				-0.0092	0.0541	-1.1333	0.0565	0.0112
				(-0.5817)	(6.6804)**	(-54.3099)**	(2.6868)**	(0.4481)
Coffee & tea				-0.1131	-0.0839	-0.2302	-1.7505	-0.3687
				(-3.4798)**	(-3.1240)**	(-6.1612)**	(-22.7322)**	(-7.2786)**

Price 2001

Quantity of	Whole milk	2% milk	Other milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk
Whole milk	-2.5387	1.3376	0.7548	0.0076	0.1867	0.0687	-0.0864	
	(-9.9968)**	(8.0104)**	(4.2754)**	(0.0671)	(1.2046)	(0.8706)	(-0.9902)	
2% milk	0.4916	-1.9014	0.6747	0.0589	0.5566	0.0321	-0.0137	
	(8.6832)**	(-22.9682)**	(10.4868)**	(1.0968)	(7.5663)**	(0.8326)	(-0.3245)	
Other milk	0.1955	0.6130	-2.3747	-0.1112	-0.2701	0.0444	0.1320	
	(2.5646)**	(7.4639)**	(-22.0391)**	(-1.7125)*	(-3.1732)**	(0.9637)	(2.5760)**	
Fruit juice				-1.1269	0.0597	0.0219	0.0029	-0.1182
				(-25.5908)**	(3.2581)**	(0.7806)	(0.0834)	(-2.6052)**
Vegetable juice				0.5254	-4.3582	0.3403	0.4707	0.9386
				(3.8913)**	(-24.1139)**	(3.5607)**	(4.4342)**	(5.6912)**
Soft drinks				-0.0747	-0.1283	-1.3054	-0.0230	-0.1677
				(-2.9136)**	(-3.9868)**	(-43.4266)**	(-0.7052)	(-4.3329)**
Coffee & tea				-0.0242	0.0613	0.0791	-1.3496	-0.2440
				(-0.4005)	(2.5056)**	(1.2019)	(-9.5038)**	(-2.5337)**

Table 5.41 Estimates of own- and cross-health information elasticities of the blockwise dependent beverage demand system, 1996 and 2001.

	Health information 1996					*Health information 2001*				
	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks
Whole milk	-0.1724	0.0182	-0.0016	-0.0103	-0.0061	0.0593	-0.1231	-0.0093	0.0076	-0.0062
	(-2.2579)**	(1.6490)*	(-0.1489)	(-1.0143)	(-0.6334)	(0.5829)	(-1.2264)	(-0.7872)	(0.5439)	(-0.3760)
2% milk	-0.0399	-0.0049	0.0167	-0.0008	0.0006	0.0684	-0.0559	-0.0068	-0.0139	0.0038
	(-1.1573)	(-0.9843)	(3.4855)**	(-0.1791)	(0.1408)	(1.3607)	(-1.1280)	(-1.1574)	(-1.9988)	(0.4708)
Other milk	0.2012	-0.0119	-0.0298	0.0244	0.0081	-0.1965	0.2015	-0.0122	0.0138	0.0025
	(4.0461)**	(-1.6609)*	(-4.3212)**	(3.6753)**	(1.2989)	(-3.2381)**	(3.3626)**	(-1.7208)	(1.6444)	(0.2562)
Fruit juice	-0.0035	-0.0065	-0.0054	0.0005	-0.0042	-0.1259	-0.0001	0.0100	0.0108	0.0062
	(-0.1032)	(-1.3474)	(-1.1490)	(0.1198)	(-1.0030)	(-3.0522)**	(-0.0022)	(2.0829)**	(1.8950)	(0.9273)
Vegetable juice	-0.1076	-0.0086	0.0168	-0.0209	0.0100	0.0505	0.0566	0.0057	-0.0126	0.0069
	(-1.0557)	(-0.5819)	(1.1892)	(-1.5375)	(0.7748)	(0.4018)	(0.4567)	(0.3872)	(-0.7255)	(0.3399)
Soft drinks	0.0004	0.0129	0.0106	-0.0052	-0.0023	0.1604	-0.0209	-0.0039	-0.0062	-0.0081
	(0.0141)	(3.1198)**	(2.6568)**	(-1.3572)	(-0.6283)	(4.2380)**	(-0.5589)	(-0.8888)	(-1.1919)	(-1.3121)
Coffee & tea	-0.0201	-0.0385	-0.1764	-0.0034	0.0026	-0.0345	0.1928	0.1158	-0.0022	-0.0007
	(-0.4982)	(-3.9217)**	(-2.8078)**	(-0.6376)	(0.5086)	(-0.5653)	(2.2295)**	(1.2064)	(-0.2637)	(-0.0713)

Table 5.42 Estimates of own- and cross-advertising elasticities of the blockwise dependent beverage demand system, 1996 and 2001.

	1996		*2001*	
	Generic milk advertising	Brand milk advertising	Generic milk advertising	Brand milk advertising
Whole milk	-0.0065 (-0.1357)	-0.0392 (-0.2773)	-0.0797 (-1.3891)	0.4679 (1.8336)*
2% milk	0.0752 (3.4954)**	0.2575 (4.0430)**	0.1136 (3.8958)**	0.1594 (1.2336)
Other milk	-0.1142 (-3.5644)**	-0.1258 (-1.3336)	-0.0427 (-1.2296)	-0.8582 (-5.5711)**
Fruit juice	0.0600 (2.6986)**	0.1797 (2.7370)**	0.0018 (0.0773)	0.3244 (3.1067)**
Vegetable juice	-0.0046 (-0.0721)	-0.0127 (-0.0669)	-0.0900 (-1.2572)	1.6807 (5.2767)**
Soft drinks	0.0033 (0.1781)	0.1337 (2.4551)**	0.0474 (2.2090)**	-0.1753 (-1.8363)*
Coffee & tea	-0.0449 (-1.7664)	-0.5422 (-7.1388)**	-0.0917 (-2.6790)**	0.0891 (0.5842)

Table 5.43 Estimates of own- and cross-price elasticities of the blockwise dependent beverage demand system calculated for the Atlantic region, 1996 and 2001.

Price 1996

Quantity of	Whole milk	2% milk	Other milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk
Whole milk	-1.5943	0.5767	0.6491	-0.0324	0.3093	-0.0931	-0.1392	
	(-14.210)**	(7.8368)**	(8.1293)**	(-0.5598)	(3.6042)**	(-2.0686)**	(-2.8094)**	
2% milk	0.2100	-1.3203	0.3876	-0.0123	0.5881	-0.0769	-0.0276	
	(8.2092)**	(-34.223)**	(13.3282)**	(-0.4279)	(11.9683)**	(-3.3420)**	(-1.1025)	
Other milk	0.2857	0.4170	-2.0875	-0.1386	-0.4724	0.0192	0.0508	
	(5.4914)**	(7.6145)**	(-28.203)**	(-2.9122)**	(-6.8392)**	(0.5146)	(1.2402)	
Fruit juice				-0.9538	0.1701	0.1059	0.1682	-0.0232
				(-31.056)**	(10.0196)**	(4.9316)**	(6.5279)**	(-0.7250)
Vegetable juice				0.7010	-4.0828	0.4536	0.6552	0.1170
				(5.8468)**	(-23.712)**	(4.7791)**	(6.2954)**	(0.8225)
Soft drinks				-0.0108	0.0609	-1.1296	0.0519	0.0114
				(-0.7008)	(6.9125)**	(-55.846)**	(2.5552)**	(0.4701)
Coffee & tea				-0.1171	-0.0627	-0.2846	-1.8675	-0.4847
				(-2.9623)**	(-2.1739)**	(-6.2251)**	(-19.797)**	(-7.8049)**

Price 2001

Quantity of	Whole milk	2% milk	Other milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk
Whole milk	-2.4117	1.2282	0.7000	-0.0055	0.1778	0.0728	-0.0928	
	(-10.336)**	(8.0058)**	(4.3152)**	(-0.0530)	(1.2480)	(1.0050)	(-1.1566)	
2% milk	0.4841	-1.8885	0.6709	0.0477	0.6242	0.0414	-0.0191	
	(8.6902)**	(-23.136)**	(10.5722)**	(0.9010)	(7.9286)**	(1.0868)	(-0.4591)	
Other milk	0.1680	0.5535	-2.2716	-0.1039	-0.2920	0.0278	0.1163	
	(2.3966)**	(7.3455)**	(-22.985)**	(-1.7441)*	(-3.6230)**	(0.6583)	(2.4712)**	
Fruit juice				-1.1325	0.0708	0.0283	-0.1220	-0.1220
				(-24.027)**	(3.5448)**	(0.9468)	(-2.5061)**	(-2.5061)**
Vegetable juice				0.7347	-5.5189	0.4392	0.6649	1.2435
				(4.0329)**	(-22.638)**	(3.4054)**	(4.6371)**	(5.5802)**
Soft drinks				-0.0792	-0.2004	-1.2998	-0.0364	-0.1714
				(-3.1956)**	(-4.6904)**	(-45.464)**	(-1.1508)	(-4.6728)**
Coffee & tea				-0.0151	0.0812	0.0948	-1.3968	-0.2869
				(-0.2131)	(2.8690)**	(1.2256)	(-8.3608)**	(-2.5317)**

Table 5.44 Estimates of own- and cross-health information elasticities of the blockwise dependent beverage demand system calculated for the Atlantic region, 1996 and 2001.

	Health information 1996					*Health information 2001*				
	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks
Whole milk	-0.1478	0.0179	-0.0006	-0.0117	-0.0077	0.0628	-0.1254	-0.0083	0.0053	-0.0088
	(-2.3754)**	(1.9958)**	(-0.0708)	(-1.4104)	(-0.9829)	(0.6657)	(-1.3456)	(-0.7520)	(0.4053)	(-0.5728)
2% milk	-0.0421	-0.0027	0.0158	-0.0009	-0.0010	0.0774	-0.0698	-0.0063	-0.0149	0.0001
	(-1.2970)	(-0.5778)	(3.5089)**	(-0.2032)	(-0.2395)	(1.4853)	(-1.3569)	(-1.0417)	(-2.1329)**	(0.0143)
Other milk	0.2257	-0.0184	-0.0321	0.0315	0.0136	-0.1879	0.1961	-0.0114	0.0143	0.0052
	(4.0998)**	(-2.3170)**	(-4.2042)**	(4.2866)**	(1.9531)**	(-3.2943)**	(3.4820)**	(-1.7192)*	(1.8086)**	(0.5608)
Fruit juice	-0.0184	-0.0015	-0.0045	-0.0049	-0.0088	-0.1294	-0.0086	0.0110	0.0104	0.0045
	(-0.4780)	(-0.2623)	(-0.8393)	(-0.9449)	(-1.8215)**	(-2.8571)**	(-0.1925)	(2.0763)**	(1.6619)*	(0.6174)
Vegetable juice	-0.1212	-0.0173	0.0204	-0.0205	0.0182	0.0445	0.1111	0.0068	-0.0121	0.0180
	(-0.9105)	(-0.9037)	(1.1083)	(-1.1558)	(1.0837)	(0.2559)	(0.6472)	(0.3363)	(-0.5045)	(0.6385)
Soft drinks	-0.0088	0.0157	0.0108	-0.0084	-0.0050	0.1550	-0.0269	-0.0035	-0.0069	-0.0094
	(-0.2969)	(3.6858)**	(2.6439)**	(-2.1184)**	(-1.3284)	(4.2687)**	(-0.7497)	(-0.8241)	(-1.3680)	(-1.5910)
Coffee & tea	-0.0124	-0.0596	-0.2112	0.0003	0.0069	-0.0384	0.2499	0.1571	-0.0031	-0.0016
	(-0.2409)	(-4.5382)**	(-2.7307)**	(0.0390)	(1.0597)	(-0.5342)	(2.3871)**	(1.3253)	(-0.3086)	(-0.1396)

Table 5.45 Estimates of own- and cross-advertising elasticities of the blockwise dependent beverage demand system calculated for the Atlantic region, 1996 and 2001.

	1996		*2001*	
	Generic milk advertising	Brand milk advertising	Generic milk advertising	Brand milk advertising
Whole milk	0.0049 (0.1282)	-0.0689 (-0.6025)	-0.0702 (-1.3283)	0.4229 (1.7966)*
2% milk	0.0757 (3.7701)	0.2198 (3.6938)**	0.1153 (3.9517)**	0.1487 (1.1447)
Other milk	-0.1361 (-3.9941)	-0.0598 (-0.5931)	-0.0401 (-1.2531)	-0.7776 (-5.4698)**
Fruit juice	0.0764 (3.2187)	0.1206 (1.7052)*	0.0024 (0.0930)	0.3418 (3.0289)**
Vegetable juice	-0.0245 (-0.2985)	0.0565 (0.2292)	-0.1301 (-1.3361)	2.2878 (5.2699)**
Soft drinks	0.0131 (0.7179)	0.0925 (1.7032)*	0.0479 (2.3596)**	-0.1659 (-1.8333)*
Coffee & tea	-0.0714 (-2.2411)	-0.6276 (-6.5831)**	-0.1094 (-2.7176)**	0.1004 (0.5591)

Table 5.46 Estimates of own- and cross-price elasticities of the blockwise dependent beverage demand system calculated for Quebec, 1996 and 2001.

				Price 1996				
Quantity of	Whole milk	2% milk	Other milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk
Whole milk	-1.5395	0.5511	0.6108	-0.0054	0.1221	-0.0713	0.0783	
	(14.5591)**	(7.9375)**	(8.1176)**	(-0.0982)	(1.4789)	(-1.6710)*	(20.8263)**	
2% milk	0.2377	-1.3492	0.4350	0.0157	0.3505	-0.0613	0.0807	
	(8.3375)**	(-31.214)**	(13.3035)**	(0.4684)	(7.4923)**	(-2.3460)**	(29.9317)**	
Other milk	0.4799	0.7212	-2.5604	-0.2099	-0.9207	0.1048	-0.1752	
	(6.0724)**	(8.6160)**	(-22.691)**	(-2.8286)**	(-8.6087)**	(1.8140)*	(-34.001)**	
Fruit juice				-0.9959	0.3645	0.0303	0.1208	-0.0677
				(-35.069)**	(8.9370)**	(1.3479)	(5.0532)**	(-2.0904)**
Vegetable juice				1.3413	-2.2091	0.1541	-0.8864	0.1330
				(7.4605)**	(-32.375)**	(4.0609)**	(-4.7079)**	(2.3539)**
Soft drinks				-0.0517	0.0520	-1.1604	0.2709	-0.0504
				(-2.6629)**	(7.0243)**	(-52.533)**	(7.2308)**	(-1.6079)
Coffee & tea				-0.2328	-0.4166	0.0990	-1.9288	-0.1637
				(-6.4612)**	(-6.4947)**	(1.4837)	(-15.010)**	(-2.8853)**

				Price 2001				
Quantity of	Whole milk	2% milk	Other milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk
Whole milk	-2.2503	1.1030	0.5766	0.0090	0.1571	0.0474	-0.0782	
	(-10.861)**	(8.0962)**	(4.0052)**	(0.0971)	(1.2428)	(0.7353)	(-1.0976)	
2% milk	0.4320	-1.7737	0.5764	0.0527	0.4412	0.0183	-0.0124	
	(8.7906)**	(-24.624)**	(10.2763)**	(1.1252)	(7.3114)**	(0.5436)	(-0.3377)	
Other milk	0.4066	1.1115	-3.3433	-0.1608	-0.3602	0.1263	0.2902	
	(3.0463)**	(7.6595)**	(-17.582)**	(-1.4010)	(-2.4778)**	(1.5447)	(3.2022)**	
Fruit juice				-1.1260	0.0464	0.0140	-0.0036	-0.1187
				(-26.959)**	(2.7106)**	(0.5260)	(-0.1096)	(-2.7682)**
Vegetable juice				0.2686	-2.8284	0.1795	0.2491	0.5106
				(3.6973)**	(-29.008)**	(3.4957)**	(4.3633)**	(5.7593)**
Soft drinks				-0.0779	-0.0736	-1.3105	-0.0226	-0.1660
				(-2.9969)**	(-3.3305)**	(-42.797)**	(-0.6809)	(-4.2110)**
Coffee & tea				-0.0270	0.0790	0.0885	-1.3672	-0.2505
				(-0.4198)	(3.1802)**	(1.2653)	(-9.0473)**	(-2.4458)**

Table 5.47 Estimates of own- and cross-health information elasticities of the blockwise dependent beverage demand system calculated for Quebec, 1996 and 2001.

	Health information 1996					*Health information 2001*				
Quantity of	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks
Whole milk	-0.1386	0.0165	-0.0007	-0.0106	-0.0068	0.0560	-0.1116	-0.0073	0.0047	-0.0079
	(-2.3663)**	(1.9508)*	(-0.0840)	(-1.3501)	(-0.9251)	(0.6676)	(-1.3483)	(-0.7509)	(0.4016)	(-0.5777)
2% milk	-0.0453	-0.0037	0.0175	-0.0009	-0.0004	0.0688	-0.0624	-0.0056	-0.0131	-0.0001
	(-1.2552)	(-0.7202)	(3.5053)**	(-0.1986)	(-0.0909)	(1.4881)	(-1.3665)	(-1.0313)	(-2.1328)**	(-0.0135)
Other milk	0.3485	-0.0298	-0.0493	0.0500	0.0223	-0.3681	0.3863	-0.0223	0.0286	0.0119
	(4.0648)**	(-2.4083)**	(-4.1498)**	(4.3642)**	(2.0627)**	(-3.2773)**	(3.4832)**	(-1.7005)*	(1.8418)*	(0.6520)
Fruit juice	-0.0179	-0.0002	-0.0038	-0.0053	-0.0087	-0.1128	-0.0089	0.0097	0.0090	0.0037
	(-0.5192)	(-0.0337)	(-0.7934)	(-1.1506)	(-2.0039)**	(-2.8105)**	(-0.2247)	(2.0659)**	(1.6140)	(0.5607)
Vegetable juice	-0.0504	-0.0062	0.0081	-0.0086	0.0068	0.0187	0.0428	0.0028	-0.0050	0.0068
	(-0.9627)	(-0.8178)	(1.1104)	(-1.2241)	(1.0357)	(0.2718)	(0.6288)	(0.3424)	(-0.5288)	(0.6087)
Soft drinks	-0.0089	0.0170	0.0116	-0.0093	-0.0057	0.1686	-0.0279	-0.0039	-0.0073	-0.0099
	(-0.2826)	(3.7259)**	(2.6508)**	(-2.2016)**	(-1.4391)	(4.2794)**	(-0.7177)	(-0.8391)	(-1.3411)	(-1.5461)
Coffee & tea	-0.0118	-0.0509	-0.1744	0.0006	0.0065	-0.0343	0.2253	0.1421	-0.0029	-0.0016
	(-0.2718)	(-4.5662)**	(-2.6606)**	(0.1108)	(1.1826)**	(-0.5272)	(2.3844)**	(1.3256)	(-0.3184)	(-0.1547)

Table 5.48 Estimates of own- and cross-advertising elasticities of the blockwise dependent beverage demand system calculated for Quebec, 1996 and 2001.

	1996		*2001*	
Quantity of	Generic milk advertising	Brand milk advertising	Generic milk advertising	Brand milk advertising
Whole milk	0.0023 (0.0647)	-0.0673 (-0.6259)	-0.0618 (-1.3150)	0.3759 (1.7978)*
2% milk	0.0801 (3.5878)	0.2446 (3.7000)**	0.1034 (3.9936)**	0.1324 (1.1490)
Other milk	-0.2203 (-4.1506)	-0.1061 (-0.6752)	-0.0928 (-1.4748)	-1.5140 (-5.4097)**
Fruit juice	0.0726 (3.4161)	0.1014 (1.5965)	0.0049 (0.2165)	0.3026 (3.0253)**
Vegetable juice	-0.0058 (-0.1796)	-0.0076 (-0.0778)	-0.0488 (-1.2632)	0.9143 (5.3094)**
Soft drinks	0.0151 (0.7728)	0.1149 (1.9692)**	0.0493 (2.2383)**	-0.1839 (-1.8733)*
Coffee & tea	-0.0610 (-2.2717)	-0.5358 (-6.6667)**	-0.0976 (-2.6795)**	0.0918 (0.5651)

Table 5.49 Estimates of own- and cross-price elasticities of the blockwise dependent beverage demand system calculated for Ontario, 1996 and 2001.

Price 1996

Quantity of	Whole milk	2% milk	Other milk	Fruit juice	Vege juice	Soft drinks	Coffee&tea	Milk
Whole milk	-2.0744	1.0180	1.1291	-0.0314	0.5206	-0.1542	-0.2052	
	(-10.572)**	(7.9023)**	(8.0808)**	(-0.3105)	(3.4727)**	(-1.9601)**	(-2.3690)**	
2% milk	0.2245	-1.3200	0.3839	-0.0052	0.5727	-0.0767	-0.0173	
	(8.3813)**	(-34.240)**	(13.2061)**	(-0.1813)	(12.0519)**	(-3.3379)**	(-0.6894)	
Other milk	0.3361	0.4634	-2.1866	-0.1598	-0.5013	0.0246	0.0410	
	(5.8561)**	(7.6769)**	(-26.812)**	(-3.0467)**	(-6.6603)**	(0.5979)	(0.9095)	
Fruit juice				-0.9539	0.1611	0.0955	0.1626	-0.0417
				(-33.589)**	(10.0235)**	(4.7993)**	(6.8156)**	(-1.4187)
Vegetable juice				0.6282	-3.8347	0.4162	0.5729	0.1533
				(5.6999)**	(-24.2347)**	(4.7724)**	(5.9959)**	(1.1756)
Soft drinks				-0.0098	0.0578	-1.1295	0.0530	0.0078
				(-0.6393)	(6.8189)**	(-55.881)**	(2.6057)**	(0.3234)
Coffee & tea				-0.1240	-0.1044	-0.2405	-1.7470	-0.3462
				(-3.8391)**	(-3.4284)**	(-6.4771)**	(-22.831)**	(-6.8810)**

Price 2001

Quantity of	Whole milk	2% milk	Other milk	Fruit juice	Vege juice	Soft drinks	Coffee&tea	Milk
Whole milk	-2.9456	1.6879	0.9547	0.0225	0.2301	0.0974	-0.1097	
	(-9.2206)**	(8.0324)**	(4.2981)**	(0.1574)	(1.1802)	(0.9814)	(-0.9982)	
2% milk	0.5015	-1.8937	0.6690	0.0632	0.6083	0.0352	-0.0153	
	(8.8333)**	(-23.077)**	(10.4905)**	(1.1852)	(7.8636)**	(0.9190)	(-0.3654)	
Other milk	0.1868	0.6015	-2.3568	-0.1148	-0.2884	0.0394	0.1289	
	(2.4787)**	(7.4334)**	(-22.203)**	(-1.7942)*	(-3.3914)**	(0.8701)	(2.5533)**	
Fruit juice				-1.1265	0.0557	0.0155	-0.0026	-0.1187
				(-26.704)**	(2.9813)**	(0.5754)	(-0.0807)	(-2.7366)**
Vegetable juice				0.6539	-5.2278	0.4234	0.6029	1.2013
				(3.8363)**	(-22.9317)**	(3.5107)**	(4.4991)**	(5.7742)**
Soft drinks				-0.0805	-0.1773	-1.3040	-0.0300	-0.1665
				(-3.1981)**	(-4.5179)**	(-44.368)**	(-0.9363)	(-4.4140)**
Coffee & tea				-0.0270	0.0581	0.0804	-1.3596	-0.2488
				(-0.4323)	(2.2584)**	(1.1813)	(-9.2518)**	(-2.4978)**

Table 5.50 Estimates of own- and cross-health information elasticities of the blockwise dependent beverage demand system calculated for Ontario, 1996 and 2001.

	Health information 1996					*Health information 2001*				
Quantity of	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks
Whole milk	-0.2577	0.0310	-0.0011	-0.0202	-0.0132	0.0856	-0.1710	-0.0113	0.0073	-0.0119
	(-2.3704)**	(1.9770)**	(-0.0755)	(-1.3882)	(-0.9631)	(0.6626)	(-1.3414)	(-0.7537)	(0.4110)	(-0.5652)
2% milk	-0.0421	-0.0027	0.0158	0.0012	-0.0010	0.0778	-0.0701	-0.0064	-0.0144	0.0001
	(-1.2971)	(-0.5775)	(3.5089)**	(0.2679)	(-0.2398)	(1.4852)	(-1.3566)	(-1.0420)	(-2.0835)**	(0.0153)
Other milk	0.2494	-0.0205	-0.0354	0.0350	0.0151	-0.2025	0.2116	-0.0123	0.0155	0.0058
	(4.0933)**	(-2.3324)**	(-4.1923)**	(4.2967)**	(1.9692)*	(-3.2925)**	(3.4835)**	(-1.7165)*	(1.8152)*	(0.5773)
Fruit juice	-0.0174	-0.0012	-0.0041	-0.0046	-0.0083	-0.1141	-0.0089	0.0098	0.0091	0.0037
	(-0.4872)	(-0.2311)	(-0.8282)	(-0.9720)	(-1.8392)	(-2.8150)**	(-0.2218)	(2.0670)**	(1.6185)	(0.5660)
Vegetable juice	-0.1114	-0.0159	0.0188	-0.0189	0.0167	0.0417	0.1038	0.0064	-0.0114	0.0168
	(-0.9113)	(-0.9020)	(1.1088)	(-1.1580)	(1.0821)	(0.2564)	(0.6466)	(0.3365)	(-0.5052)	(0.6375)
Soft drinks	-0.0088	0.0157	0.0108	-0.0084	-0.0049	0.1605	-0.0273	-0.0036	-0.0071	-0.0096
	(-0.2971)	(3.6861)**	(2.6437)**	(-2.1189)**	(-1.3288)	(4.2742)**	(-0.7360)	(-0.8308)	(-1.3566)	(-1.5719)
Coffee & tea	-0.0117	-0.0477	-0.1710	-0.0004	0.0051	-0.0332	0.2189	0.1382	-0.0028	-0.0016
	(-0.2826)	(-4.5273)**	(-2.7288)**	(-0.0675)	(0.9781)	(-0.5250)	(2.3835)**	(1.3256)	(-0.3215)	(-0.1594)

Table 5.51 Estimates of own- and cross-advertising elasticities of the blockwise dependent beverage demand system calculated for Ontario, 1996 and 2001.

	1996		*2001*	
Quantity of	Generic milk advertising	Brand milk advertising	Generic milk advertising	Brand milk advertising
Whole milk	0.0057 (0.0850)	-0.1239 (-0.6201)	-0.0976 (-1.3488)	0.5782 (1.7946)*
2% milk	0.0757 (3.7707)**	0.2197 (3.6939)**	0.1158 (3.9502)**	0.1494 (1.1445)
Other milk	-0.1519 (-4.0267)**	-0.0681 (-0.6094)	-0.0446 (-1.2932)	-0.8371 (-5.4611)**
Fruit juice	0.0718 (3.2576)**	0.1128 (1.7173)*	0.0047 (0.2051)	0.3056 (3.0258)**
Vegetable juice	-0.0223 (-0.2950)	0.0522 (0.2306)	-0.1214 (-1.3337)	2.1393 (5.2712)**
Soft drinks	0.0131 (0.7191)	0.0924 (1.7036)*	0.0485 (2.3076)**	-0.1732 (-1.8510)*
Coffee & tea	-0.0530 (-2.0765)**	-0.5027 (-6.5812)**	-0.0945 (-2.6674)**	0.0896 (0.5670)

Table 5.52 Estimates of own- and cross-price elasticities of the blockwise dependent beverage demand system calculated for the Prairie region, 1996 and 2001.

Price 1996

Quantity of	Whole milk	2% milk	Other milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk
Whole milk	-1.9515	0.9458	1.1406	-0.0427	0.1899	-0.1090	0.1500	
	(-10.799)**	(7.9644)**	(8.8497)**	(-0.4525)	(1.3460)	(-1.4953)	(23.3446)**	
2% milk	0.2463	-1.3599	0.4815	-0.0050	0.4153	-0.0598	0.0871	
	(8.2851)**	(-30.716)**	(14.3814)**	(-0.1447)	(8.1410)**	(-2.2349)**	(30.2369)**	
Other milk	0.1931	0.3149	-1.7940	-0.1004	-0.5077	0.0255	-0.1109	
	(5.1030)**	(8.0741)**	(-34.037)**	(-2.9004)**	(-9.3455)**	(0.9549)	(-20.811)**	
Fruit juice				-1.0110	0.4762	0.0467	0.1583	-0.0467
				(-28.696)**	(9.0506)**	(1.6773)*	(5.3193)**	(-1.1596)
Vegetable juice				2.9560	-3.5869	0.3398	-1.9199	0.2493
				(7.5797)**	(-24.310)**	(4.1282)**	(-4.7063)**	(2.0295)**
Soft drinks				-0.0565	0.0783	-1.1580	0.2666	-0.0428
				(-2.9768)**	(8.3568)**	(-53.218)**	(7.2334)**	(-1.3829)
Coffee & tea				-0.1727	-0.4599	0.0839	-1.8881	-0.2247
				(-5.0698)**	(-6.8225)**	(1.3399)	(-15.633)**	(-4.2143)**

Price 2001

Quantity of	Whole milk	2% milk	Other milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk
Whole milk	-2.8315	1.5713	0.9229	-0.0056	0.2180	0.1023	-0.0997	
	(-9.4046)**	(7.9365)**	(4.4076)**	(-0.0413)	(1.1864)	(1.09400	(-0.9633)	
2% milk	0.5462	-2.0185	0.7719	0.0541	0.6157	0.0538	-0.0162	
	(8.6300)**	(-21.844)**	(10.7364)**	(0.9032)	(7.5522)**	(1.2516)	(-0.3443)	
Other milk	0.1359	0.4992	-2.1654	-0.1012	-0.2758	0.0166	0.0920	
	(2.1164)**	(7.2972)**	(-24.144)**	(-1.8706)**	(-3.7443)**	(0.4333)	(2.1529)**	
Fruit juice				-1.1339	0.0715	0.0307	0.0091	-0.1237
				(-23.561)**	(3.6133)**	(1.0081)	(0.2438)	(-2.4915)**
Vegetable juice				0.6312	-4.8651	0.3706	0.5438	1.0853
				(4.0574)**	(-23.36)**	(3.3649)**	(4.4439)**	(5.7085)**
Soft drinks				-0.0794	-0.1753	-1.2988	-0.0364	-0.1668
				(-3.2122)**	(-4.5761)**	(-45.741)**	(-1.1734)	(-4.5915)**
Coffee & tea				-0.0200	0.0533	0.0710	-1.3484	-0.2435
				(-0.3345)	(2.1529)**	(1.0880)	(-9.5728)**	(-2.5492)**

Table 5.53 Estimates of own- and cross-health information elasticities of the blockwise dependent beverage demand system calculated for the Prairie region, 1996 and 2001.

	Health information 1996					*Health information 2001*				
Quantity of	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks
Whole milk	-0.2359	0.0278	-0.0012	-0.0177	-0.0114	0.0807	-0.1613	-0.0107	0.0069	-0.0112
	(-2.3599)**	(1.9275)*	(-0.0897)	(-1.3229)	(-0.9009)	(0.6630)	(-1.3419)	(-0.7535)	(0.4102)	(-0.5662)
2% milk	-0.0462	-0.0039	0.0179	0.0004	-0.0004	0.0872	-0.0783	-0.0072	-0.0166	0.0003
	(-1.2524)	(-0.7293)	(3.5053)**	(0.0911)	(-0.0826)	(1.4829)	(-1.3497)	(-1.0489)	(-2.1186)**	(0.0344)
Other milk	0.1584	-0.0126	-0.0227	0.0220	0.0093	-0.1696	0.1768	-0.0103	0.0128	0.0045
	(4.1210)**	(-2.2735)**	(-4.2538)**	(4.2759)**	(1.9226)*	(-3.2961)**	(3.4784)**	(-1.7230)*	(1.7974)*	(0.5341)
Fruit juice	-0.0210	-0.0007	-0.0048	-0.0061	-0.0105	-0.1324	-0.0086	0.0112	0.0107	0.0047
	(-0.4974)	(-0.1090)	(-0.8217)	(-1.0868)	(-1.9646)*	(-2.8637)**	(-0.1878)	(2.0776)**	(1.6687)*	(0.6256)
Vegetable juice	-0.1073	-0.0141	0.0173	-0.0179	0.0154	0.0382	0.0946	0.0058	-0.0104	0.0153
	(-0.9435)	(-0.8570)	(1.0991)	(-1.1752)	(1.0730)	(0.2572)	(0.6457)	(0.3368)	(-0.5065)	(0.6361)
Soft drinks	-0.0089	0.0167	0.0114	-0.0092	-0.0057	0.1537	-0.0268	-0.0035	-0.0068	-0.0093
	(-0.2867)	(3.7303)**	(2.6480)**	(-2.2101)**	(-1.4475)	(4.2670)**	(-0.7533)	(-0.8223)	(-1.3710)	(-1.5960)
Coffee & tea	-0.0117	-0.0476	-0.1638	0.0004	0.0059	-0.0316	0.2095	0.1324	-0.0027	-0.0016
	(-0.2868)	(-4.5637)**	(-2.6598)**	(0.0735)	(1.1548)	(-0.5214)	(2.3821)**	(1.3258)	(-0.3265)	(-0.1670)

Table 5.54 Estimates of own- and cross-advertising elasticities of the blockwise dependent beverage demand system calculated for the Prairie region, 1996 and 2001.

	1996		*2001*	
Quantity of	Generic milk advertising	Brand milk advertising	Generic milk advertising	Brand milk advertising
Whole milk	0.0007 (0.0121)	-0.1189 (-0.6472)	-0.0918 (-1.3462)	0.5450 (1.7949)*
2% milk	0.0816 (3.5727)**	0.2502 (3.6954)**	0.1290 (3.9205)**	0.1672 (1.1413)
Other milk	-0.0919 (-3.8649)**	-0.0375 (-0.5323)	-0.0343 (-1.1882)	-0.7031 (-5.4819)**
Fruit juice	0.0867 (3.3252)**	0.1221 (1.5662)	0.0019 (0.0749)	0.3489 (3.0291)**
Vegetable juice	-0.0183 (-0.2601)	-0.0228 (-0.1083)	-0.1106 (-1.3301)	1.9543 (5.2732)**
Soft drinks	0.0153 (0.7942)	0.1135 (1.9741)*	0.0478 (2.3733)**	-0.1641 (-1.8284)*
Coffee & tea	-0.0556 (-2.2147)**	-0.5015 (-6.6693)**	-0.0900 (-2.6479)**	0.0863 (0.5700)

Table 5.55 Estimates of own- and cross-price elasticities of the blockwise dependent beverage demand system calculated for British Columbia, 1996 and 2001.

Price 1996

Quantity of	Whole milk	2% milk	Other milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk
Whole milk	-1.6193	0.6120	0.7348	-0.0217	0.1356	-0.0913	0.1232	
	(-13.456)**	(7.7446)**	(8.5701)**	(-0.3445)	(1.4432)	(-1.8781)*	(22.3479)**	
2% milk	0.2661	-1.4125	0.5208	0.0047	0.4705	-0.0782	0.1217	
	(8.1690)**	(-28.597)**	(13.9598)**	(0.1232)	(8.1788)**	(-2.6215)**	(31.9598)**	
Other milk	0.2548	0.4109	-1.9434	-0.1196	-0.5965	0.0561	-0.1467	
	(5.6091)**	(8.6081)**	(-30.128)**	(-2.8248)**	(-9.1588)**	(1.7113)*	(-29.358)**	
Fruit juice				-1.0044	0.4748	0.0296	0.1625	-0.0601
				(-31.047)**	(9.3030)**	(1.1585)	(5.9380)**	(-1.6263)
Vegetable juice				3.7889	-4.3229	0.4653	-2.5182	0.3559
				(7.5457)**	(-22.767)**	(4.3897)**	(-4.7951)**	(2.2536)**
Soft drinks				-0.0557	0.0950	-1.1716	0.3007	-0.0465
				(-2.7048)**	(8.4775)**	(-49.593)**	(7.4489)**	(-1.3819)
Coffee & tea				-0.1683	-0.5066	0.0732	-1.7567	-0.1613
				(-6.0884)**	(-7.3799)**	(1.4798)	(-18.369)**	(-3.8238)**

Price 2001

Quantity of	Whole milk	2% milk	Other milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk
Whole milk	-2.2951	1.1141	0.6549	0.0031	0.1772	0.0240	-0.0581	
	(-10.702)**	(7.9037)**	(4.3918)**	(0.0321)	(1.3513)	(0.3589)	(-0.7889)	
2% milk	0.5352	-2.0119	0.7707	0.0678	0.7317	0.0035	0.0000	
	(8.5734)**	(-21.902)**	(10.7813)**	(1.1374)	(7.9805)**	(0.0823)	(-0.0001)	
Other milk	0.1327	0.4815	-2.1357	-0.1067	-0.3333	0.0339	0.0800	
	(2.1378)**	(7.2445)**	(-24.514)**	(-2.0303)**	(-4.3348)**	(0.9102)	(1.9297)*	
Fruit juice				-1.1283	0.0671	0.0183	0.0012	-0.1189
				(-25.751)**	(3.2133)**	(0.6588)	(0.0361)	(-2.6285)**
Vegetable juice				0.9761	-7.1600	0.7276	0.8202	1.6890
				(3.9198)**	(-21.507)**	(4.1215)**	(4.1920)**	(5.5459)**
Soft drinks				-0.0664	-0.1786	-1.3373	-0.0028	-0.1901
				(-2.2501)**	(-4.1753)**	(-37.566)**	(-0.0744)	(-4.0917)**
Coffee & tea				-0.0333	-0.0144	0.0606	-1.3004	-0.2146
				(-0.6846)**	(-0.5492)**	(1.1484)	(-11.426)**	(-2.7792)**

Table 5.56 Estimates of own- and cross-health information elasticities of the blockwise dependent beverage demand system calculated for British Columbia, 1996 and 2001.

	Health information 1996					*Health information 2001*				
Quantity of	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks
Whole milk	-0.1574	0.0187	-0.0008	-0.0119	-0.0077	0.0579	-0.1154	-0.0076	0.0048	-0.0081
	(-2.3639)**	(1.9420)*	(-0.0862)	(-1.3398)	(-0.9159)	(0.6670)	(-1.3474)	(-0.7512)	(0.4028)	(-0.5761)
2% milk	-0.0511	-0.0045	0.0200	-0.0010	-0.0003	0.0867	-0.0779	-0.0071	-0.0170	0.0003
	(-1.2411)	(-0.7643)	(3.5052)**	(-0.1859)	(-0.0502)	(1.4830)	(-1.3500)	(-1.0486)	(-2.1513)**	(0.0335)
Other milk	0.1961	-0.0161	-0.0279	0.0276	0.0120	-0.1645	0.1713	-0.0100	0.0124	0.0043
	(4.1020)**	(-2.3319)**	(-4.2151)**	(4.3171)**	(1.9829)*	(-3.2964)**	(3.4769)**	(-1.7241)*	(1.7934)*	(0.5250)
Fruit juice	-0.0196	-0.0005	-0.0044	-0.0058	-0.0097	-0.1192	-0.0088	0.0102	0.0095	0.0040
	(-0.5048)	(-0.0836)	(-0.8123)	(-1.1084)	(-1.9780)*	(-2.8310)**	(-0.2109)	(2.0707)**	(1.6348)	(0.5851)
Vegetable juice	-0.1379	-0.0182	0.0223	-0.0229	0.0199	0.0604	0.1524	0.0093	-0.0165	0.0248
	(-0.9411)	(-0.8619)	(1.0977)	(-1.1690)	(1.0776)	(0.2541)	(0.6493)	(0.3356)	(-0.5017)	(0.6418)
Soft drinks	-0.0090	0.0180	0.0124	-0.0098	-0.0060	0.1994	-0.0306	-0.0047	-0.0083	-0.0111
	(-0.2656)	(3.7073)**	(2.6615)**	(-2.1662)**	(-1.4046)	(4.2816)**	(-0.6652)	(-0.8596)	(-1.2943)	(-1.4706)
Coffee & tea	-0.0114	-0.0368	-0.1293	-0.0005	0.0040	-0.0244	0.1674	0.1069	-0.0024	-0.0017
	(-0.3600)	(-4.5469)**	(-2.6561)**	(-0.1109)	(1.0136)	(-0.4978)	(2.3718)**	(1.3266)	(-0.3582)	(-0.2161)

Table 5.57 Estimates of own- and cross-advertising elasticities of the blockwise dependent beverage demand system calculated for British Columbia, 1996 and 2001.

	1996		*2001*	
Quantity of	Generic milk advertising	Brand milk advertising	Generic milk advertising	Brand milk advertising
Whole milk	0.0018 (0.0447)	-0.0776 (-0.6340)	0.3889 (1.7974)	0.0579 (0.6670)
2% milk	0.0895 (3.5134)**	0.2773 (3.6771)**	0.1663 (1.1414)	0.0867 (1.4830)
Other milk	-0.1180 (-3.9877)**	-0.0519 (-0.5922)	-0.6821 (-5.4855)**	-0.1645 (-3.2964)**
Fruit juice	0.0807 (3.3561)**	0.1133 (1.5766)	0.3176 (3.0273)**	-0.1192 (-2.8310)**
Vegetable juice	-0.0245 (-0.2703)	-0.0305 (-0.1121)	3.1248 (5.2652)**	0.0604 (0.2541)
Soft drinks	0.0143 (0.6862)	0.1215 (1.9486)*	-0.2240 (-1.9298)*	0.1994 (4.2816)**
Coffee & tea	-0.0376 (-1.9258)*	-0.3891 (-6.6605)**	0.0722 (0.5888)	-0.0244 (-0.4978)

Table 5.58 Estimates of own- and cross-price elasticities of the blockwise dependent beverage demand system calculated for high household income level, 1996 and 2001.

Price 1996

Quantity of	Whole milk	2% milk	Other milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk
Whole milk	-1.9968	0.9523	1.1754	0.0071	0.1986	-0.1005	-0.1620	
	(-10.570)**	(7.6708)**	(8.7259)**	(0.0720)	(1.3464)	(-1.3187)	(-1.9385)*	
2% milk	0.2852	-1.4555	0.5748	0.0287	0.4530	-0.0591	0.0073	
	(8.0086)**	(-27.177)**	(14.1986)**	(0.6906)	(7.6656)**	(-1.8287)*	(0.2073)	
Other milk	0.2249	0.3728	-1.8638	-0.1309	-0.5359	0.0267	0.0363	
	(5.4192)**	(8.6533)**	(-32.008)**	(-3.4240)**	(-9.1791)**	(0.9058)	(1.1246)	
Fruit juice				-0.9939	0.3983	0.0351	0.1162	-0.0671
				(-36.212)**	(9.3183)**	(1.6134)	(5.0322)**	(-2.1448)**
Vegetable juice				2.7129	-3.4131	0.3057	-1.7823	0.2784
				(7.4624)**	(-24.813)**	(3.9849)**	(-4.6870)**	(2.4373)**
Soft drinks				-0.0506	0.0734	-1.1516	0.2517	-0.0507
				(-2.7500)**	(8.2556)**	(-55.166)**	(7.1541)**	(-1.7200)*
Coffee & tea				-0.2424	-0.4578	0.0763	-1.9277	-0.1619
				(-6.7385)**	(-6.6400)**	(1.1453)	(-15.026)**	(-2.8571)**

Price 2001

Quantity of	Whole milk	2% milk	Other milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk
Whole milk	-3.0888	1.7734	1.0472	0.0508	0.2448	0.1024	-0.1217	
	(-9.0182)**	(7.8729)**	(4.3964)**	(0.3307)	(1.1714)	(0.9622)	(-1.0328)	
2% milk	0.6006	-2.1420	0.8554	0.1067	0.6550	0.0499	-0.0248	
	(8.5485)**	(-20.879)**	(10.7149)**	(1.6007)	(7.3887)**	(1.0472)	(-0.4740)	
Other milk	0.1407	0.5203	-2.1942	-0.1184	-0.2800	0.0247	0.0996	
	(2.1288)**	(7.4030)**	(-23.807)**	(-2.1301)**	(-3.7074)**	(0.6277)	(2.2664)**	
Fruit juice				-1.1226	0.0428	0.0043	-0.0116	-0.1167
				(-29.332)**	(2.3920)**	(0.1755)	(-0.3882)	(-2.9761)**
Vegetable juice				0.5916	-5.0328	0.4072	0.5805	1.1674
				(3.6379)**	(-23.152)**	(3.5409)**	(4.5430)**	(5.8904)**
Soft drinks				-0.0843	-0.1661	-1.3054	-0.0285	-0.1631
				(-3.3310)**	(-4.4314)**	(-44.019)**	(-0.8804)	(-4.2873)**
Coffee & tea				-0.0337	0.0682	0.0874	-1.3717	-0.2519
				(-0.5162)	(2.5901)**	(1.2292)	(-8.9338)**	(-2.4209)**

Table 5.59 Estimates of own- and cross-health information elasticities of the blockwise dependent beverage demand system calculated for high household income level, 1996 and 2001.

	Health information 1996					*Health information 2001*				
Quantity of	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks
Whole milk	-0.2466	0.0291	-0.0013	-0.0185	-0.0119	0.0917	-0.1833	-0.0122	0.0079	-0.0127
	(-2.3596)**	(1.9268)*	(-0.0899)	(-1.3219)	(-0.9000)	(0.6622)	(-1.3409)	(-0.7539)*	(0.4117)	(-0.5642)
2% milk	-0.0550	-0.0050	0.0217	-0.0001	-0.0002	0.0965	-0.0865	-0.0080	-0.0185	0.0005
	(-1.2344)	(-0.7846)	(3.5047)**	(-0.0240)	(-0.0314)	(1.4813)	(-1.3451)	(-1.0533)	(-2.1193)**	(0.0468)
Other milk	0.1761	-0.0143	-0.0251	0.0246	0.0106	-0.1746	0.1820	-0.0106	0.0132	0.0047
	(4.1114)**	(-2.3056)**	(-4.2336)**	(4.2991)**	(1.9557)	(-3.2957)**	(3.4797)**	(-1.7219)*	(1.8008)*	(0.5422)
Fruit juice	-0.0175	-0.0001	-0.0036	-0.0052	-0.0085	-0.1017	-0.0092	0.0088	0.0080	0.0030
	(-0.5237)	(-0.0180)	(-0.7874)	(-1.1638)	(-2.0118)**	(-2.7644)**	(-0.2541)	(2.0540)**	(1.5680)	(0.5080)
Vegetable juice	-0.1001	-0.0131	0.0162	-0.0167	0.0143	0.0398	0.0988	0.0061	-0.0108	0.0160
	(-0.9444)	(-0.8552)	(1.0997)	(-1.1775)	(1.0713)	(0.2568)	(0.6462)	(0.3367)	(-0.5059)	(0.6368)
Soft drinks	-0.0089	0.0161	0.0109	-0.0089	-0.0055	0.1623	-0.0274	-0.0037	-0.0071	-0.0097
	(-0.2990)	(3.7426)**	(2.6394)**	(-2.2353)**	(-1.4724)	(4.2756)**	(-0.7318)	(-0.8327)	(-1.3531)	(-1.5660)
Coffee & tea	-0.0118	-0.0508	-0.1741	0.0006	0.0065	-0.0349	0.2290	0.1444	-0.0029	-0.0016
	(-0.2722)	(-4.5661)**	(-2.6606)**	(0.1099)	(1.1819)	(-0.5284)	(2.3849)**	(1.3255)	(-0.3167)	(-0.1521)

Table 5.60 Estimates of own- and cross-advertising elasticities of the blockwise dependent beverage demand system calculated for high household income level, 1996 and 2001.

	1996		*2001*	
Quantity of	Generic milk advertising	Brand milk advertising	Generic milk advertising	Brand milk advertising
Whole milk	0.0007 (0.0103)	-0.1244 (-0.6480)	-0.1049 (-1.3514)	0.6198 (1.7944)*
2% milk	0.0960 (3.4785)**	0.2996 (3.6660)**	0.1422 (3.9007)**	0.1849 (1.1391)
Other milk	-0.1042 (-3.9323)**	-0.0444 (-0.5649)	-0.0359 (-1.2078)	-0.7234 (-5.4785)**
Fruit juice	0.0707 (3.4347)**	0.0986 (1.6027)	0.0068 (0.3297)	0.2766 (3.0185)**
Vegetable juice	-0.0168 (-0.2565)	-0.0210 (-0.1069)	-0.1156 (-1.3319)	2.0398 (5.2722)**
Soft drinks	0.0158 (0.8574)	0.1098 (1.9885)*	0.0487 (2.2917)**	-0.1755 (-1.8562)*
Coffee & tea	-0.0609 (-2.2704)**	-0.5349 (-6.6668)**	-0.0994 (-2.6860)**	0.0931 (0.5641)

Table 5.61 Estimates of own- and cross-price elasticities of the blockwise dependent beverage demand system calculated for medium household income level, 1996 and 2001.

Price 1996

Quantity of	Whole milk	2% milk	Other milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk
Whole milk	-1.8338	0.8307	0.9683	-0.0160	0.1700	-0.0782	-0.1407	
	(-11.507)**	(7.9337)**	(8.5272)**	(-0.1917)	(1.3664)	(-1.2169)	(-1.9958)*	
2% milk	0.2456	-1.3655	0.4675	0.0085	0.4057	-0.0480	0.0037	
	(8.2254)**	(-30.469)**	(13.8194)**	(0.2452)	(7.9989)**	(-1.7720)*	(0.1249)	
Other milk	0.2843	0.4316	-2.0015	-0.1315	-0.6040	0.0340	0.0553	
	(5.8410)**	(8.4405)**	(-28.975)**	(-2.9014)**	(-8.9415)**	(0.9688)	(1.4453)	
Fruit juice				-1.0006	0.4241	0.0472	0.1305	-0.0629
				(-32.660)**	(3.1619)**	(1.9450)*	(5.0554)**	(-1.7993)*
Vegetable juice				2.6393	-3.3316	0.2875	-1.7189	0.2548
				(7.5172)**	(-25.075)**	(3.8814)**	(-4.6800)**	(2.3084)**
Soft drinks				-0.0532	0.0708	-1.1473	0.2419	-0.0487
				(-2.9837)**	(8.1809)**	(-56.551)**	(7.1033)**	(-1.7013)*
Coffee & tea				-0.2154	-0.4573	0.0669	-1.9436	-0.1879
				(-5.8549)**	(-6.5669)**	(0.9816)	(-14.801)**	(-3.2389)**

Price 2001

Quantity of	Whole milk	2% milk	Other milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk
Whole milk	-2.6783	1.4506	0.8321	0.0106	0.2017	0.0797	-0.0983	
	(-9.6905)**	(7.9811)**	(4.3302)**	(0.0857)	(1.1960)	(0.9281)	(-1.0348)	
2% milk	0.5129	-1.9439	0.7092	0.0626	0.5802	0.0370	-0.0175	
	(8.6832)**	(-22.543)**	(10.5778)**	(1.1180)	(7.5961)**	(0.9222)	(-0.3993)	
Other milk	0.1678	0.5593	-2.2763	-0.1096	-0.2711	0.0328	0.1147	
	(2.3794)**	(7.3943)**	(-22.939)**	(-1.8331)*	(-3.4133)**	(0.7739)	(2.4288)**	
Fruit juice				-1.1282	0.0577	0.0193	0.0004	-0.1196
				(-25.840)**	(3.1266)**	(0.6942)	(0.0120)	(-2.6603)**
Vegetable juice				0.5508	-4.5224	0.3533	0.5019	0.9876
				(3.8872)**	(-23.847)**	(3.5230)	(4.5043)**	(5.7063)**
Soft drinks				-0.0786	-0.1462	-1.3052	-0.0287	-0.1689
				(-3.1004)**	(-4.2928)**	(-44.076)**	(-0.8882)	(-4.4352)**
Coffee & tea				-0.0240	0.0677	0.0839	-1.3649	-0.2556
				(-0.3769)	(2.6507)**	(1.2085)	(-9.1081)**	(-2.5152)**

Table 5.62 Estimates of own- and cross-health information elasticities of the blockwise dependent beverage demand system calculated for medium household income level, 1996 and 2001.

	Health information 1996					*Health information 2001*				
Quantity of	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks
Whole milk	-0.2081	0.0246	-0.0011	-0.0156	-0.0100	0.0742	-0.1482	-0.0098	0.0063	-0.0103
	(-2.3607)**	(1.9304)*	(-0.0890)	(-1.3262)	(-0.9039)	(0.6637)	(-1.3429)	(-0.7531)	(0.4090)	(-0.5679)
2% milk	-0.0467	-0.0040	0.0182	0.0000	-0.0004	0.0816	-0.0734	-0.0067	-0.0155	0.0002
	(-1.2510)	(-0.7336)	(3.5054)**	(-0.1492)	(-0.0786)	(1.4842)	(-1.3535)	(-1.0452)	(-2.1189)**	(0.0240)
Other milk	0.2106	-0.0174	-0.0300	0.0297	0.0130	-0.1887	0.1970	-0.0115	0.0143	0.0052
	(4.0961)**	(-2.3465)**	(-4.2041)**	(4.3268)**	(1.9980)**	(-3.2942)**	(3.4821)**	(-1.7191)*	(1.8090)*	(0.5618)
Fruit juice	-0.0189	-0.0003	-0.0041	-0.0056	-0.0093	-0.1187	-0.0088	0.0101	0.0095	0.0040
	(-0.5103)	(-0.0646)	(-0.8051)	(-1.1245)	(-1.9879)**	(-2.8295)**	(-0.2119)	(2.0704)**	(1.6333)	(0.5834)
Vegetable juice	-0.0967	-0.0126	0.0156	-0.0161	0.0138	0.0349	0.0860	0.0053	-0.0095	0.0139
	(-0.9449)	(-0.8543)	(1.1000)	(-1.1787)	(1.0703)	(0.2582)	(0.6446)	(0.3372)	(-0.5079)	(0.6343)
Soft drinks	-0.0090	0.0157	0.0106	-0.0087	-0.0055	0.1620	-0.0274	-0.0037	-0.0071	-0.0096
	(-0.3082)	(3.7514)**	(2.6325)**	(-2.2539)**	(-1.4908)	(4.2753)**	(-0.7325)	(-0.8324)	(-1.3537)	(-1.5670)
Coffee & tea	-0.0119	-0.0520	-0.1783	0.0007	0.0067	-0.0340	0.2234	0.1409	-0.0028	-0.0016
	(-0.2669)	(-4.5669)**	(-2.6608)**	(0.1229)	(1.1916)	(-0.5266)	(2.3841)**	(1.3256)	(-0.3193)	(-0.1561)

Table 5.63 Estimates of own- and cross-advertising elasticities of the blockwise dependent beverage demand system calculated for medium household income level, 1996 and 2001.

	1996		*2001*	
Quantity of	Generic milk advertising	Brand milk advertising	Generic milk advertising	Brand milk advertising
Whole milk	0.0010 (0.0186)	-0.1044 (-0.6446)	-0.0840 (-1.3415)	0.5004 (1.7953)*
2% milk	0.0824 (3.5653)**	0.2530 (3.6932)**	0.1211 (3.9368)**	0.1566 (1.1431)
Other milk	-0.1279 (-4.0185)**	-0.0573 (-0.6076)	-0.0403 (-1.2556)	-0.7809 (-5.4693)**
Fruit juice	0.0771 (3.3791)**	0.1081 (1.5843)	0.0039 (0.1673)	0.3164 (3.0272)**
Vegetable juice	-0.0161 (-0.2545)	-0.0202 (-0.1061)	-0.1003 (-1.3258)	1.7794 (5.2757)**
Soft drinks	0.0162 (0.9048)	0.1074 (1.9991)**	0.0486 (2.2943)**	-0.1751 (-1.8554)*
Coffee & tea	-0.0630 (-2.2902)**	-0.5483 (-6.6656)**	-0.0967 (-2.6759)**	0.0911 (0.5657)

Table 5.64 Estimates of own- and cross-price elasticities of the blockwise dependent beverage demand system calculated for low household income level, 1996 and 2001.

Price 1996

Quantity of	Whole milk	2% milk	Other milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk
Whole milk	-1.6212	0.6099	0.6709	-0.0406	0.3187	-0.1169	-0.1209	
	(-13.865)**	(7.9507)**	(8.0628)**	(-0.6738)	(3.5661)**	(-2.4904)**	(-2.3433)**	
2% milk	0.2019	-1.3002	0.3665	-0.0169	0.5319	-0.0887	-0.0140	
	(8.2645)**	(-35.399)**	(13.2420)**	(-0.6176)	(12.1420)**	(-4.0559)**	(-0.5870)	
Other milk	0.3149	0.4449	-2.1651	-0.1389	-0.4876	0.0451	0.0345	
	(5.6115)**	(7.5187)**	(-27.091)**	(-2.7025)**	(-6.6340)**	(1.1164)	(0.7798)	
Fruit juice				-0.9539	0.1546	0.1015	0.1929	-0.0228
				(-29.254)**	(10.1646)**	(4.4672)**	(7.0322)**	(-0.6709)
Vegetable juice				0.5485	-3.3833	0.3738	0.4738	0.0895
				(5.9358)**	(-25.470)**	(5.1068)**	(5.9104)**	(0.8155)
Soft drinks				-0.0066	0.0586	-1.1412	0.0659	0.0195
				(-0.3927)	(6.9865)**	(-50.954)**	(2.9135)**	(0.7220)
Coffee & tea				-0.0935	-0.0936	-0.1990	-1.7238	-0.3844
				(-3.0218)**	(-3.3936)**	(-5.6093)**	(-23.590)**	(-7.9919)**

Price 2001

Quantity of	Whole milk	2% milk	Other milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk
Whole milk	-2.2929	1.1370	0.6191	-0.0080	0.1602	0.0490	-0.0701	
	(-10.710)**	(8.0768)**	(4.1607)**	(-0.0832)	(1.2262)	(0.7353)	(-0.9526)	
2% milk	0.4432	-1.7975	0.5942	0.0399	0.5169	0.0192	-0.0087	
	(8.7715)**	(-24.281)**	(10.337)**	(0.8316)	(7.7380)**	(0.5552)	(-0.2301)	
Other milk	0.2479	0.7290	-2.6062	-0.1117	-0.2845	0.0682	0.1664	
	(2.7617)**	(7.4984)**	(-20.443)**	(-1.4539)	(-2.8733)**	(1.2495)	(2.7472)**	
Fruit juice				-1.1331	0.0674	0.0285	0.0082	-0.1228
				(-23.836)**	(3.5110)**	(0.9467)	(0.2215)	(-2.5017)**
Vegetable juice				0.4858	-4.0142	0.3115	0.4118	0.8318
				(4.0167)**	(-24.776)**	(3.6380)**	(4.3304)**	(5.6246)**
Soft drinks				-0.0725	-0.1151	-1.3112	-0.0223	-0.1736
				(-2.7710)**	(-3.9131)**	(-42.640)**	(-0.6734)	(-4.3704)**
Coffee & tea				-0.0235	0.0483	0.0697	-1.3310	-0.2334
				(-0.4207)	(2.1024)**	(1.1461)	(-10.143)**	(-2.6230)**

Table 5.65 Estimates of own- and cross-health information elasticities of the blockwise dependent beverage demand system calculated for low household income level, 1996 and 2001.

	Health information 1996					Health information 2001				
Quantity of	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks
Whole milk	-0.1540	0.0186	-0.0006	-0.0122	-0.0080	0.0578	-0.1152	-0.0076	0.0048	-0.0081
	(-2.3748)**	(1.9932)**	(-0.0715)	(-1.4074)	(-0.9802)	(0.6670)	(-1.3475)	(-0.7512)	(0.4028)	(-0.5762)
2% milk	-0.0404	-0.0025	0.0150	-0.0006	-0.0010	0.0706	-0.0639	-0.0057	-0.0135	-0.0001
	(-1.3043)	(-0.5519)	(3.5066)**	(-0.1460)	(-0.2628)	(1.4875)	(-1.3642)	(-1.0339)	(-2.1318)**	(-0.0067)
Other milk	0.2443	-0.0201	-0.0347	0.0342	0.0148	-0.2448	0.2563	-0.0149	0.0188	0.0074
	(4.0946)**	(-2.3294)**	(-4.1946)**	(4.2948)**	(1.9661)*	(-3.2872)**	(3.4848)**	(-1.7102)	(1.8276)*	(0.6102)
Fruit juice	-0.0192	-0.0017	-0.0048	-0.0050	-0.0093	-0.1306	-0.0086	0.0111	0.0105	0.0046
	(-0.4720)	(-0.2826)	(-0.8465)	(-0.9270)	(-1.8098)	(-2.8598)**	(-0.1905)	(2.0769)**	(1.6647)*	(0.6208)
Vegetable juice	-0.0937	-0.0133	0.0158	-0.0159	0.0139	0.0300	0.0731	0.0045	-0.0081	0.0118
	(-0.9135)	(-0.8977)	(1.1101)	(-1.1635)	(1.0779)	(0.2601)	(0.6423)	(0.3380)	(-0.5110)	(0.6306)
Soft drinks	-0.0087	0.0172	0.0121	-0.0090	-0.0052	0.1694	-0.0280	-0.0039	-0.0073	-0.0099
	(-0.2667)	(3.6495)**	(2.6608)**	(-2.0528)**	(-1.2644)	(4.2797)**	(-0.7159)	(-0.8398)	(-1.3395)	(-1.5436)
Coffee & tea	-0.0116	-0.0454	-0.1631	-0.0005	0.0047	-0.0291	0.1945	0.1233	-0.0026	-0.0017
	(-0.2940)	(-4.5239)**	(-2.7283)**	(-0.0966)	(0.9555)	(-0.5146)	(2.3793)**	(1.3260)	(-0.3357)	(-0.1812)

Table 5.66 Estimates of own- and cross-advertising elasticities of the blockwise dependent beverage demand system calculated for low household income level, 1996 and 2001.

	1996		*2001*	
Quantity of	Generic milk advertising	Brand milk advertising	Generic milk advertising	Brand milk advertising
Whole milk	0.0049	-0.0720	-0.0640	0.3883
	(0.1223)	(-0.6049)	(-1.3191)	(1.7974)*
2% milk	0.0730	0.2101	0.1058	0.1357
	(3.8107)**	(3.7047)**	(3.9834)**	(1.1480)
Other milk	-0.1485	-0.0663	-0.0573	-1.0097
	(-4.0204)**	(-0.6062)	(-1.3732)	(-5.4409)**
Fruit juice	0.0803	0.1271	0.0022	0.3447
	(3.1929)**	(1.6971)*	(0.0855)	(3.0290)**
Vegetable juice	-0.0181	0.0445	-0.0850	1.5200
	(-0.2860)	(0.2341)	(-1.3167)	(5.2807)**
Soft drinks	0.0114	0.0999	0.0494	-0.1850
	(0.5624)	(1.6618)*	(2.2317)**	(-1.8754)*
Coffee & tea	-0.0494	-0.4784	-0.0827	0.0812
	(-2.0307)**	(-6.5787)**	(-2.6114)**	(0.5755)

Table 5.67 Estimates of own- and cross-price elasticities of the blockwise dependent beverage demand system calculated for couple with children type of households, 1996 and 2001.

	Price 1996							
Quantity of	Whole milk	2% milk	Other milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk
Whole milk	-1.6654	0.6751	0.7716	-0.0101	0.1414	-0.0643	-0.1245	
	(-12.935)**	(7.9832)**	(8.4147)**	(-0.1503)	(1.4066)	(-1.2375)	(-2.1851)**	
2% milk	0.2352	-1.3463	0.4428	0.0109	0.4263	-0.0462	-0.0021	
	(8.2707)**	(-31.355)**	(13.6641)**	(0.3268)	(8.3402)**	(-1.7794)*	(-0.0760)	
Other milk	0.3167	0.4753	-2.0937	-0.1459	-0.6629	0.0404	0.0752	
	(5.9096)**	(8.4071)**	(-27.432)**	(-2.9110)**	(-8.8834)**	(1.0406)	(1.7754)*	
Fruit juice				-0.9984	0.4371	0.0454	0.1210	-0.0575
				(-33.697)**	(9.3341)**	(1.9311)*	(4.8555)**	(-1.6982)*
Vegetable juice				3.3046	-3.9176	0.3603	-2.1409	0.3110
				(7.5037)**	(-23.520)**	(3.8773)**	(-4.6476)**	(2.2453)**
Soft drinks				-0.0524	0.0844	-1.1466	0.2395	-0.0475
				(-2.9526)**	(8.1582)**	(-56.793)**	(7.0727)**	(-1.6672)*
Coffee & tea				-0.2413	-0.4986	0.0768	-2.0152	-0.2172
				(-5.9724)**	(-6.4792)**	(1.0203)	(-13.913)**	(-3.3930)**

	Price 2001							
Quantity of	Whole milk	2% milk	Other milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk
Whole milk	-2.3671	1.1869	0.6628	0.0133	0.1743	0.0723	-0.0949	
	(-10.469)**	(7.9844)**	(4.2173)**	(0.1314)	(1.2622)	(1.0290)	(-1.2198)	
2% milk	0.4922	-1.9096	0.6742	0.0675	0.6356	0.0455	-0.0216	
	(8.6612)**	(-22.902)**	(10.4054)**	(1.2459)	(7.9184)**	(1.1711)	(-0.5083)	
Other milk	0.2164	0.6642	-2.4683	-0.1204	-0.3014	0.0435	0.1549	
	(2.6506)**	(7.5320)**	(-21.333)**	(-1.7268)*	(-3.2722)**	(0.8803)	(2.8127)**	
Fruit juice				-1.1256	0.0550	0.0138	-0.0043	-0.1180
				(-27.173)**	(2.8990)**	(0.5203)	(-0.1336)	(-2.7702)**
Vegetable juice				0.7156	-5.6584	0.4479	0.6965	1.3184
				(3.8065)**	(-22.511)**	(3.3683)**	(4.7094)**	(5.7451)**
Soft drinks				-0.0844	-0.2104	-1.2984	-0.0395	-0.1658
				(-3.4430)**	(-4.7512)**	(-45.838)**	(-1.2491)	(-4.5782)**
Coffee & tea				-0.0235	0.0959	0.1045	-1.4213	-0.2965
				(-0.3065)	(3.1897)**	(1.2521)	(-7.8907)**	(-2.4270)**

Table 5.68 Estimates of own- and cross-health information elasticities of the blockwise dependent beverage demand system calculated for couple with children type of households, 1996 and 2001.

	Health information 1996					*Health information 2001*				
Quantity of	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks
Whole milk	-0.1683	0.0199	-0.0009	-0.0127	-0.0082	0.0609	-0.1216	-0.0080	0.0051	-0.0085
	(-2.3629)**	(1.9384)	(-0.0871)	(-1.3356)	(-0.9122)	(0.6661)	(-1.3462)	(-0.7517)	(0.4044)	(-0.5739)
2% milk	-0.0450	-0.0037	0.0174	-0.0005	-0.0004	0.0790	-0.0712	-0.0065	-0.0153	0.0002
	(-1.2560)	(-0.7176)	(3.5052)**	(-0.0998)	(-0.0934)	(1.4849)	(-1.3555)	(-1.0431)	(-2.1387)**	(0.0182)
Other milk	0.2336	-0.0195	-0.0332	0.0331	0.0145	-0.2215	0.2316	-0.0134	0.0170	0.0065
	(4.0881)**	(-2.3643)**	(-4.1897)**	(4.3381)**	(2.0165)**	(-3.2900)**	(3.4845)**	(-1.7134)	(1.8217)*	(0.5943)
Fruit juice	-0.0184	-0.0003	-0.0040	-0.0054	-0.0090	-0.1118	-0.0089	0.0096	0.0089	0.0036
	(-0.5140)	(-0.0517)	(-0.8002)	(-1.1355)	(-1.9946)*	(-2.8067)**	(-0.2273)	(2.0650)**	(1.6101)	(0.5562)
Vegetable juice	-0.1210	-0.0159	0.0196	-0.0201	0.0174	0.0458	0.1146	0.0070	-0.0125	0.0186
	(-0.9422)	(-0.8596)	(1.0984)	(-1.1719)	(1.0754)	(0.2557)	(0.6475)	(0.3362)	(-0.5041)	(0.6389)
Soft drinks	-0.0090	0.0157	0.0105	-0.0087	-0.0054	0.1532	-0.0268	-0.0034	-0.0068	-0.0093
	(-0.3099)	(3.7529)**	(2.6312)**	(-2.2572)**	(-1.4941)	(4.2663)**	(-0.7546)	(-0.8217)	(-1.3720)	(-1.5977)
Coffee & tea	-0.0122	-0.0577	-0.1968	0.0011	0.0076	-0.0418	0.2699	0.1694	-0.0032	-0.0016
	(-0.2469)	(-4.5697)**	(-2.6618)**	(0.1724)	(1.2280)	(-0.5387)	(2.3888)**	(1.3251)	(-0.3023)	(-0.1300)

Table 5.69 Estimates of own- and cross-advertising elasticities of the blockwise dependent beverage demand system calculated for couple with children type of households, 1996 and 2001.

	1996		*2001*	
Quantity of	Generic milk advertising	Brand milk advertising	Generic milk advertising	Brand milk advertising
Whole milk	0.0016 (0.0366)	-0.0834 (-0.6373)	-0.0679 (-1.3252)	0.4099 (1.7968)*
2% milk	0.0796 (3.5922)**	0.2431 (3.7013)**	0.1175 (3.9457)**	0.1517 (1.1440)
Other milk	-0.1434 (-4.0564)**	-0.0656 (-0.6266)	-0.0503 (-1.3345)	-0.9144 (-5.4511)**
Fruit juice	0.0751 (3.3947)**	0.1051 (1.5894)	0.0050 (0.2262)	0.3000 (3.0249)**
Vegetable juice	-0.0211 (-0.2655)	-0.0263 (-0.1103)	-0.1342 (-1.3371)	2.3589 (5.2693)**
Soft drinks	0.0163 (0.9133)	0.1069 (2.0009)**	0.0478 (2.3782)**	-0.1634 (-1.8267)*
Coffee & tea	-0.0722 (-2.3649)**	-0.6081 (-6.6593)**	-0.1190 (-2.7417)**	0.1075 (0.5553)

Table 5.70 Estimates of own- and cross-price elasticities of the blockwise dependent beverage demand system calculated for other households, 1996 and 2001.

Price 1996

Quantity of	Whole milk	2% milk	Other milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk
Whole milk	-1.7523	0.7707	0.8773	-0.0282	0.1562	-0.0990	-0.1134	
	(-12.121)**	(8.1138)**	(8.5180)**	(-0.3732)	(1.3841)	(-1.6962)*	(-1.7747)*	
2% milk	0.2245	-1.3193	0.4196	-0.0014	0.3738	-0.0627	0.0104	
	(8.3562)**	(-32.748)**	(13.8028)**	(-0.0440)	(8.1193)**	(-2.5746)**	(0.3949)	
Other milk	0.2833	0.4175	-2.0028	-0.1213	-0.6007	0.0565	0.0437	
	(5.8163)**	(8.1492)**	(-28.950)**	(-2.6727)**	(-8.9172)**	(1.6069)	(1.1404)	
Fruit juice				-1.0066	0.4431	0.0365	0.1520	-0.0507
				(-30.195)**	(9.0052)**	(1.3873)	(5.3985)**	(-1.3304)
Vegetable juice				2.3951	-3.1085	0.2843	-1.5672	0.2085
				(7.5538)**	(-25.898)**	(4.2474)**	(-4.7245)**	(2.0882)**
Soft drinks				-0.0559	0.0700	-1.1650	0.2824	-0.0437
				(-2.8203)**	(8.2330)**	(-51.271)**	(7.3057)**	(-1.3507)
Coffee & tea				-0.1797	-0.4299	0.0923	-1.8615	-0.2062
				(-5.4913)**	(-6.8045)**	(1.5377)	(-16.086)**	(-4.0382)**

Price 2001

Quantity of	Whole milk	2% milk	Other milk	Fruit juice	Vegetable juice	Soft drinks	Coffee & tea	Milk
Whole milk	-2.6485	1.4314	0.8116	0.0024	0.1987	0.0645	-0.0816	
	(-9.7525)**	(8.0148)**	(4.2986)**	(0.0196)	(1.1991)	(0.7644)	(-0.8749)	
2% milk	0.4940	-1.8987	0.6740	0.0527	0.5374	0.0230	-0.0085	
	(8.7334)**	(-23.021)**	(10.5138)**	(0.9852)	(7.5013)**	(0.5977)	(-0.2024)	
Other milk	0.1824	0.5878	-2.3317	-0.1076	-0.2625	0.0444	0.1194	
	(2.4741)**	(7.4150)**	(-22.421)**	(-1.7166)*	(-3.2014)**	(0.9990)	(2.4167)**	
Fruit juice				-1.1305	0.0615	0.0237	0.0045	-0.1212
				(-24.798)**	(3.3061)**	(0.8189)	(0.1275)	(-2.5796)**
Vegetable juice				0.4637	-3.9305	0.3062	0.3967	0.8160
				(3.9448)**	(-24.960)**	(3.6795)**	(4.2930)**	(5.6806)**
Soft drinks				-0.0729	-0.1082	-1.3134	-0.0203	-0.1724
				(-2.7620)**	(-3.7990)**	(-42.134)**	(-0.6059)	(-4.2811)**
Coffee & tea				-0.0268	0.0446	0.0673	-1.3249	-0.2265
				(-0.4917)	(1.9784)*	(1.1373)	(-10.367)**	(-2.6132)**

Table 5.71 Estimates of own- and cross-health information elasticities of the blockwise dependent beverage demand system calculated for other households, 1996 and 2001.

	Health information 1996					*Health information 2001*				
Quantity of	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks	Milk positive	Milk negative	Fruit juice	Vegetable juice	Soft drinks
Whole milk	-0.1889	0.0223	-0.0010	-0.0142	-0.0091	0.0729	-0.1456	-0.0096	0.0062	-0.0101
	(-2.3615)**	(1.9335)*	(-0.0882)	(-1.3298)	(-0.9071)	(0.6639)	(-1.3431)	(-0.7530)	(0.4086)	(-0.5683)
2% milk	-0.0425	-0.0034	0.0163	0.0000	-0.0005	0.0782	-0.0705	-0.0064	-0.0148	0.0001
	(-1.2645)	(-0.6903)	(3.5046)**	(0.0091)	(-0.1184)	(1.4851)	(-1.3562)	(-1.0424)	(-2.1140)**	(0.0162)
Other milk	0.2110	-0.0174	-0.0300	0.0298	0.0130	-0.1982	0.2070	-0.0121	0.0151	0.0056
	(4.0960)**	(-2.3468)**	(-4.2038)**	(4.3270)**	(1.9983)**	(-3.2930)**	(3.4832)**	(-1.7173)	(1.8134)*	(0.5729)
Fruit juice	-0.0201	-0.0005	-0.0045	-0.0059	-0.0100	-0.1247	-0.0087	0.0106	0.0100	0.0043
	(-0.5020)	(-0.0931)	(-0.8158)	(-1.1003)	(-1.9730)**	(-2.8459)**	(-0.2006)	(2.0740)**	(1.6502)*	(0.6033)
Vegetable juice	-0.0875	-0.0114	0.0141	-0.0146	0.0124	0.0292	0.0710	0.0044	-0.0079	0.0115
	(-0.9464)	(-0.8511)	(1.1009)	(-1.1827)	(1.0673)	(0.2606)	(0.6419)	(0.3381)	(-0.5116)	(0.6298)
Soft drinks	-0.0089	0.0174	0.0119	-0.0095	-0.0058	0.1722	-0.0282	-0.0040	-0.0074	-0.0100
	(-0.2751)	(3.7179)**	(2.6556)**	(-2.1861)**	(-1.4240)	(4.2808)**	(-0.7104)	(-0.8422)	(-1.3347)	(-1.5357)
Coffee & tea	-0.0116	-0.0454	-0.1569	0.0002	0.0055	-0.0282	0.1892	0.1201	-0.0026	-0.0017
	(-0.2981)	(-4.5616)**	(-2.6593)**	(0.0452)	(1.1336)	(-0.5119)	(2.3781)**	(1.3261)	(-0.3394)	(-0.1870)

Table 5.72 Estimates of own- and cross-advertising elasticities of the blockwise dependent beverage demand system calculated for other households, 1996 and 2001.

	1996		*2001*	
Quantity of	Generic milk advertising	Brand milk advertising	Generic milk advertising	Brand milk advertising
Whole milk	0.0013 (0.0255)	-0.0943 (-0.6418)	-0.0825 (-1.3404)	0.4918 (1.7954)*
2% milk	0.0757 (3.6374)**	0.2292 (3.7147)**	0.1164 (3.9488)**	0.1501 (1.1444)
Other milk	-0.1281 (-4.0192)**	-0.0574 (-0.6079)	-0.0433 (-1.2823)	-0.8196 (-5.4635)**
Fruit juice	0.0827 (3.3445)**	0.1163 (1.5727)	0.0030 (0.1238)	0.3305 (3.0284)**
Vegetable juice	-0.0142 (-0.2479)	-0.0178 (-0.1036)	-0.0825 (-1.3148)	1.4773 (5.2817)**
Soft drinks	0.0147 (0.7347)	0.1176 (1.9602)**	0.0497 (2.2107)**	-0.1886 (-1.8819)*
Coffee & tea	-0.0521 (-2.1712)**	-0.4791 (-6.6703)**	-0.0801 (-2.5964)**	0.0795 (0.5777)

Appendix B Previous Studies for Non-Alcoholic Beverage Demand in Other countries.

Table 2.2 Previous demand studies for non-alcoholic beverages in other countries.

Number	Country	Author	Study (demand systems, data and time period)	What and how variables included	Commodities
1	India	Abdulai, Jain, and Sharma (1999)	Linear AIDS model, Indian 1995 household survey data. Results indicate that for commodity groups, demand is elastic only for milk and milk products in both rural and urban areas of India. The impact of demographic variables such as region, household size, education level of household head, and seasonality, was generally significant.	Region, urbanization, education, household size, and seasonality.	Milk and milk products; cereals and pulses; edible oils; meat, fish, and eggs; vegetables and fruits; other foods
2	Australia	Bewley (1987)	The demand for milk in Australia. The 1984 Household Expenditure Survey. A three-equation generalized addilog demand system (GADS).	Use two one-way classifications from the 1984 Australian Household Expenditure Survey.	Delivered milk, non-delivered milk and other milk products.
3	U. S.	Brown (1994)	Examine the impacts of nonprice and nonincome variables on the demand in the levels versions of the Rotterdam demand model. A.C. Neilsen Marketing Research weekly data for the period from week ending 14 November 1987 through 26 December 1992.	Advertising, seasonality variables. A combined scaling-translation specification.	Grapefruit and other juice.
4	U.S.	Brown and Lee (1993)	This paper examines several approaches to introduce advertising in systems of demand equations. Rotterdam model.	Advertising.	Fruit juice products.
5	U.S.	Brown and Lee (1997)	This paper incorporates generic and brand advertising into the Rotterdam demand system, based on utility theory. Weekly data from the week ending 12 December 1992 through the week ending 30 March 1996 was studied.	Brand advertising, generic advertising, 52 weekly seasonality. The advertising variables were treated as psychological stocks following Maddala (1992).	Five brand orange juices and a sixth category for all other

					juices and juice drinks.
6	U.S.	Chung and Kaiser (2002)	This paper examines how seriously the data aggregation may affect the evaluation of generic advertising. The paper derived a statistics procedure and showed that the aggregation bias exists as long as the covariances between marketing variables and corresponding parameters are nonzero, or the linearly aggregated data are used for non-linear models. The procedure is applied to the evaluation of U.S. milk advertising programs.	Significant aggregation bias in all three variables estimated: price, income, and advertising. The advertising variable is incorporated in the double-log demand equation as a demand shifter.	Fluid milk.
7	U.S.	Chung and Kaiser (1999)	This study examined the impacts of alternative measures of advertising exposure on the evaluation of advertising effectiveness. This study used quarterly data of post-buy actual GRPs and corresponding advertising expenditures for the New York City. The econometric analysis, however, found that the two alternatives produced quite different advertising elasticities and rates of return. The results indicate that the choice of advertising exposure measure may provide researchers with different evaluation results.	Advertising.	Milk.
8	U.S.	Chung and Kaiser (2000)	This study develops a varying-parameter advertising model specifying advertising parameters as a function of advertising strategies and market environments to examine the sources of change in advertising effectiveness over time. The model is applied to the New York City fluid milk market for the period from January, 1986 through June, 1995. Results indicate that advertising strategies and market environments play important roles in determining advertising effectiveness. Particularly, demographic factors were more important than economic factors.	Advertising and other demographic variables.	Milk.
9	U.S.	Gao and Lee (1995)	This study presents a structural factor analysis approach to measure the impact of retail store advertising (i.e., newspaper advertising, in-store display, and point-of-purchase display) on consumer	Advertising expenditures.	Orange juice and grapefruit juice.

			purchases in retail level. The results show that the demand for orange juice and grapefruit juice was affected by their own advertising, while the demand for apple juice was only affected by advertising of competitive juices.		
10	U.S.	Gould (1996)	This paper analyzed the U.S. fluid milk consumption using a household panel dataset from April 1991 to March 1992 (only fluid milk purchased for at-home consumption is included in this data set). Own- and cross-price and substitution elasticities are estimated along with effects of household demographic characteristics, using a translog demand system.	Household characteristics, meal planner characteristics, and region of residence.	Whole milk, lowfat milk and skim milk.
11	U.S.	Gould, Cox and Perali (1990)	AIDS model. Time series monthly data from 1955 to 1985. A time-series based demand system analysis of the market for lowfat and whole milk products is developed incorporating the effects of changes in prices and demographic characteristics.	Prices and demographic characteristics. Demographic scaling is used. The advantage of use of the time series data is the inclusion of the FAFH consumption; the cross-sectional data only include FAH consumption.	Whole milk, lowfat milk, juices, other beverages and other food.
12	U.S.	Heien and Wessells (1990)	This paper estimated a demand system of dairy products from the USDA's 1977-1978 household food consumption survey data. The AIDS model is used. The zero expenditure problem is treated with a two-step estimator following Lee (1978).		Milk, cheese, cottage cheese, butter, margarine, ice cream, coffee and tea, sodas and fruit ades, vegetable and citrus juice, meat and all other food.
13	U.S.	Heien and Wessells (1988)	The demand for dairy products in U.S. using the 1977-78 USDA Household Food Consumption Survey data. AIDS model was chosen.	Economic variables (prices and income) and demographic variables.	Milk, cheese, cottage cheese,

			Because over 70% of the observed budget shares are nonzero, this paper treated the zero problem as it minimized. The missing prices are estimated by regressing observed prices for each item on regional and seasonal dummies and on household income (Dagenais, 1983; Gourieroux and Monfort, 1981). Production interval tests utilizing time-series data are performed for milk and butter.		butter, margarine, fruit, meat, coffee and tea, soda fruit ades and vegetable juice, citrus juice, and all other food.
14	U.S.	Jensen (1995)	This study measures the impacts of use of nutrition information and household socio-economic characteristics on market participation and amount purchased of whole-fat and low-fat milk in the South. Data are from the 1987-88 Nationwide Food Consumption Survey. The results showed that use of nutrition information had little effect on purchase levels, but did affect market participation. Results suggest promotion of milk purchases on the basis of nutritional benefits through health professionals and product packaging are useful tools for the dairy industry to attract market participation.		
15	U.S.	Kinnucan (1986)	Milk demand includes the effects of demographic factors (age and race) and the advertising expenditures. Single equation. Monthly data from January 1971 to June 1980.	Milk price, coffee price, cola price, the percentage of the population in NYC under age 20, the percentage of the population in NYC which is nonwhite, time trend, income, 11 seasonality dummies.	Fluid milk.
16	U.S.	Kinnucan, Chang and Venkateswaran (1993)	Advertising wearout, defined as the declining effectiveness of a commercial or campaign associated with increased exposure, is examined from a generic advertising perspective. The study estimated a time-varying parameter model using data from the first fourteen years of an advertising campaign for fluid milk. Results suggest that the cycles predicted by wearout theory do exist in the case of specific generic	Generic milk advertising.	fluid milk.

			thematic appeals.		
17	U.S.	Lenz, Kaiser and Chung (1998)	Generic milk advertising effectiveness study. Fluid milk demand equations for New York City, Albany, Syracuse, Rochester, and Buffalo are estimated within monthly data for the period from January 1986 through June 1995. The results indicate that generic milk advertising is positive and statistically significant at the 10% significance level in each market. The policy implication is that New York dairy farmers should consider some reallocation of advertising expenditures among markets.	Prices, income, fat concerns, seasonality dummies, competing advertising, and milk advertising. Advertising variables and seasonality dummies are modeled as demand shifters. Beverage advertising expenditure variables is combined real advertising expenditures for all nonalcoholic and nondairy beverages.	Fluid milk.
18	U.S.	Liu and Forker (1988)	A transfer was used to estimate the fluid milk demand equation of New York City. The consumption effect of a generic fluid milk Advertising program in the city was found to be positive and statistically significant. The resulting higher blend price of milk was found to have a negligible effect on the subsequent supply of milk. Though being successful in generating position returns on advertising, it was found that a 35 percent reduction in the advertising expenditures would have been optimal in the marginal sense.	Advertising variables are modeled in the Lancaster household production function. The moving-average, autoregressive polynomials and the white noise processes are applied to model the dynamics of advertising.	Milk.
19	U.S.	Schmit, Chung, Dong, Kaiser and Gould (2000)	A two-step model with sample selection is applied to panel data of U.S. households to estimate at-home demand for fluid milk and cheese, incorporating advertising expenditures. (single equation) Generic advertising programs for fluid milk and cheese were effective at increasing conditional purchase quantities, with very little effect on the probability of purchase. In contrast to aggregate studies, the long-run generic advertising elasticities for cheese were larger than for those of fluid milk.	Advertising variables are incorporated as a demand shifter.	Milk (includes whole milk, reduced fat milk, light milk and skim milk) and cheese (includes american, mozzarella, processed and other cheese).
20	U.S.	Schmit, Gould,	The impacts of generic cheese advertising on U.S.	A matrix of exogenous market,	Total cheese,

		Dong, Kaiser and Chung (2003)	household cheese purchases are examined. A panel of U.S. household cheese purchase for the years 1997-99. Apply the model suggested by Zeger and Brookmeyer (1986) to account for censored purchases while at the same time allowing for an autocorrelated error structure. A pooled cross-sectional Tobit model.	household and advertising variables such as household/mal planner characteristics, household size/composition, race/ethnicity, household geographic location and advertising expenditures (generic and brand) variables.	natural cheese and processed cheese.
21	U.S.	Tomek and Kaiser (1999)	This paper used a general-to-specific modeling philosophy to get a stable estimates of the long-run dvertising elasticity for fluid milk.	Fluid milk consumption, prices, income, time trend, seasonal dummies, generic and brand fluid milk advertising expenditures, percentage of U.S. population 5 years old or younger, between 6 and 15 years of age, and between 16 and 19 years of age, price for cereal, composite advertising variable under the polynomial and end-point restrictions.	Fluid milk.
22	U.S.	Ueda and Frechette (2002)	This study investigates whether the change is due to price and expenditure effects or to a more fundamental preference change in milk demand, using both parametric and nonparametric analytical approaches. A nonparametric approach first finds evidence of structural change. A parametric likelihood-ratio test then confirms the existence of structural change using a Kalman filter specification. The value of this technical analysis of milk preferences is its implication for labeling initiatives. Milk fat labels have allowed consumers to act on a new set of preferences, thereby improving consumer welfare.		Whole milk, lowfat milk, and skim milk.
23	U.S.	Vande Kamp and Kaiser (1999)	A generalized methodology for estimating irreversible functions is developed. This approach, which accommodates short-term irreversibility and long-term reversibility, is an improvement over previous irreversibility studies that imposed both short- and long-term irreversibility. Using the proposed		

			methodology, irreversibility in the demand response to fluid milk advertising in New York City is evaluated. Irreversibility is found to exist and, in particular, consumers are found to react more rapidly to increases in advertising compared to decreases. This result may have important implications for optimal temporal advertising strategies.		
24	U.S.	Vande Kamp and Kaiser (2000)	This study develops an approach to obtain optimal temporal advertising strategies when consumers response to advertising is asymmetric. Using this approach, optimal strategies for generic fluid milk advertising in New York City are determined. Results indicate that pulsed advertising policies are significantly more effective in increasing demand than a uniform advertising policy. Sensitivity analyses show that the optimal advertising policies are insensitive to reasonable variations in interest rates and the inclusion of milk demand seasonality in the model.		Fluid milk.
25	Japan	Watanabe, Suzuki and Kaiser (1997)	This article identifies consumer characteristics associated with preferences toward milk products. Data come from interviews conducted by the NMPAJ of Japanese consumers in 1995. A technique known as Quantification Theory Type III (QYTIII) is used. The results indicate that men, middle-aged people, and people with no calcium concerns prefer soda and alcoholic beverages to milk beverages, while younger people, larger families, and people with calcium concerns drank more milk more often. The results also indicate that non-milk drinkers, older people, people with no calcium concerns, and men are less inclined to consume cheese and yogurt, and stronger health concerns increased demand for milk and dairy products.	Dependent variable is the summarized characteristic of respondent and is called the "sample score". Independent variables include demographic and socioeconomic variables.	Yogurt drinks, acidophilus milk beverages, white milk, tea, mineral water, green tea, milk beverages such as chocolate milk, Chinese tea, fruit juice, coffee, sport drinks, alcoholic drinks such as

					beer, and soda drinks.
26	Japan	Watanabe, Suzuki and Kaiser (1997)	This paper examines the relative importance of various consumer attributes on beverage consumption decisions in Japan, using a logit model. Data: a major consumer survey conducted in 1996 by the National Milk Promotion Association of Japan. The results showed that many of the consumer attributes have a statistically significant association with the decision to consumer the various beverages.	Gender, age, household size, marital status, educational level, house ownership and household annual income.	Regular milk, flavored milk, lactic acid beverages, soda beverages, juice, green tea, coffee, tea, Chinese tea.
27	U.S.	Xiao, Kinnucan and Kaiser (1998)	This paper determines whether advertising of non-alcoholic beverages has effect on aggregate demand using Rotterdam model and time series data, and tests the structural change.	Prices, real per capita income, age, FAFH, advertising intensity.	Milk, juices, soft drinks, coffee & tea, and other goods.
28	U.S.	Yen and Lin (2002)	Milk, soft drink and juice consumption is investigated for children and adolescents in U.S. The full-information maximum likelihood estimator (FIML) and the quasi maximum-likelihood (QML) are used to estimate a censored system of beverage equations. The results showed displacement of milk by soft drinks as a child or adolescent grows older. Income, TV watching, gender, race, and other demographic variables also play significant roles in determining beverage consumption.	Quantity consumed of milk, soft drinks and juice; individual age in years; per capita household income; number of hours watching TV over 2 days; number of survey days falling on weekend; dummy variables of meal planner's education and individual characteristics.	Milk, soft drinks, juice.
29	Korea	Yoo and Yang (2000)	This paper analyzed bottled water expenditures data collected in Seoul 1997. Parametric (Heckman's two-step) and semiparametric (quasi-ML estimator) models are employed and the results are compared. The semiparametric model is found outperformed the parametric model significantly.	Consumption (monthly expenditure for bottled water consumption with zero observations), quality variables, and other demographic variables.	Bottled water.