University of Alberta

Purchasing Patterns of Nutritionally Enhanced and Value Added Foods: The Case of the Alberta Shell Egg Industry

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Abstract

There has been a proliferation of value added eggs such as omega 3, free/range, vitamin enhanced and organic, in the Canadian egg market with the intention of addressing consumer concerns which include food safety, environment, health/nutrition and animal welfare concerns. Very little is known about how and which consumers are responding to these egg industry led initiatives.

Most of the previous Canadian egg demand studies have treated shell eggs as a homogeneous product while this study treats eggs as differentiated products. Most previous research and studies on the demand for product attributes have tended to use a stated preference method. In this study, revealed preference methods using household purchase data are used.

Homescan panel data starting with purchases from the week ending 02/02/2002 until the week ending 01/01/2005 is provided by ACNielsen. This data, detailing individual households' egg purchases, was used to carry out the analysis. It is assumed that each of the egg types possesses a unique mix of quality attributes that may be identified by the consumer through the label. Applying a conditional logit model, the results showed that consumers' response to different egg types is unique to certain demographic groups and that in general consumers suffered a loss in their welfare due to the introduction of value added egg products. Willingness to pay was highest for organic and omega 3 eggs respectively and lowest for free range/run and vitamin enhanced eggs respectively.

ACKNOWLEGMENTS

"I believe through learning and application of what you learn, you can solve any problem, overcome any obstacle and achieve any goal that you can set for yourself."

"Never consider the possibility of failure; as long as you persist, you will be successful."

"Difficulties come not to obstruct, but to instruct."

Brian Tracy

First and foremost I would like to thank the Almighty God for bringing me this far. I would like to recognize and thank my supervisor Dr. Ellen Goddard for her support and guidance and for putting up with me even when you were very busy. I would like to thank my committee members especially Dr. Peter Boxall for their valuable input and the time they spent on my thesis. I would also like to thank the Alberta Livestock Industry Development Fund and the Co-operative Program in Agric-Marketing and Business for funding my research.

I would like to dedicate this thesis to my parents Dr. Peter Eriki and Mrs. Molly Anyait for all the financial help that they provided to me through my entire academic life. I would like thank them for being such great role models to me and for encouraging me not to give up even when things were getting tough. I would also like to dedicate this thesis to my siblings Simon Peter Eriki, Joseph Benedict Etonu, Anoku Patrick, Peter Paul, Aledo Margaret and Caroline Akello. I also dedicate this thesis to the E-Clan and

my grandmother Tata Aledo who was such a great inspiration not only to me but everyone she met; may her soul rest in peace.

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Chapter 1 Introduction

The Canadian egg industry is an important player in the poultry sector. Canada's egg and poultry industries make significant contributions to the Canadian economy in rural and urban areas. Together, the industries have total annual revenues of $6.5 billion and provide employment for nearly 72,000 people (Canadian Egg Marketing Agency 2004b). As is shown in Table 1, the egg industry is second only to the chicken sector in terms of farm cash receipts in the poultry sector (National Farm Products Council, 2002).

Table 1. Farm Cash Receipts in Million of Dollars for the Four Major Sectors in the Canadian Poultry Industry

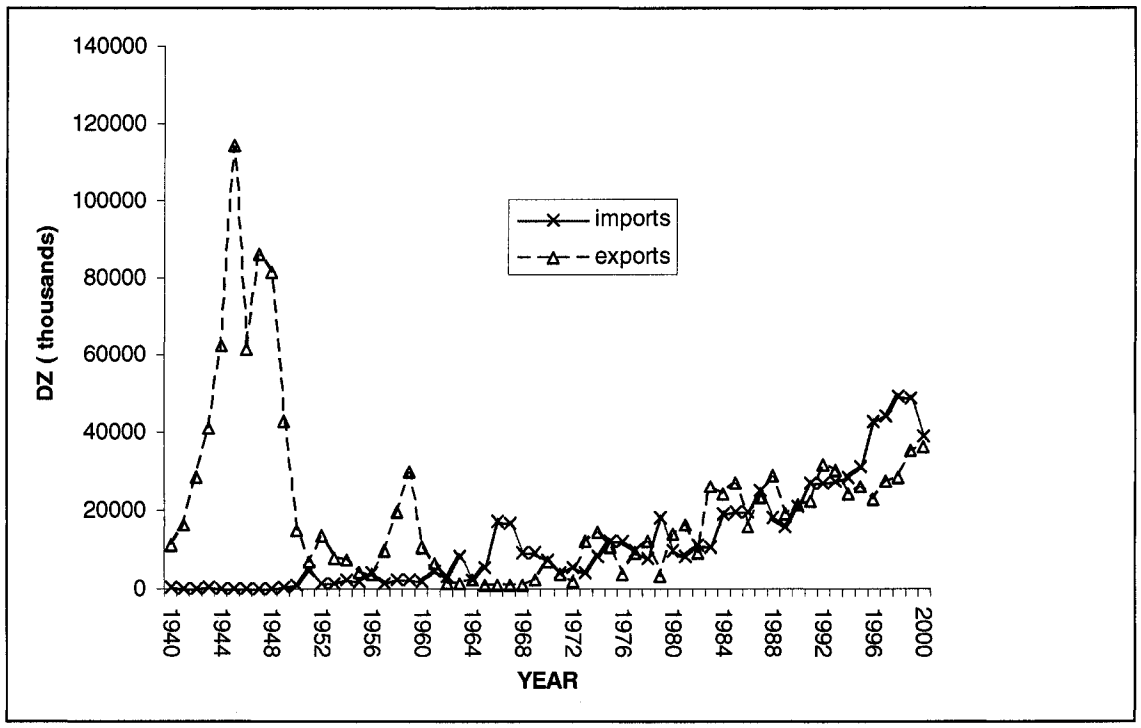
	Chicken	Egg	Turkey	Broiler
2001	1,508.10	**565.40**	261.10	205.20
2002	1,451.70	**584.10**	257.00	206.50
2003	1,524.40	**556.40**	260.70	205.70
2004	1,577.7	**565.9**	267.6	198.7

Source: National Farm Products Council, 2002, 2003, 2004 & 2005

1.0. The Structure of the Egg Industry

Eggs from producers are either destined for the table market (i.e. shell egg sector) or the breaker market (i.e. the processing sector). Eighty-two percent of eggs produced are sold as table eggs while the remaining eighteen percent are processed into liquid, frozen, or dried forms (Agriculture and Agri-Food Canada, 2004b). Portions of the table and breaker market are supplied by a small quantity of shell and processed egg imports. Exporters of poultry products to Canada include the US, Brazil and Thailand (National Farm Products Council, 2004). Canadian egg exports mostly consist of liquid and dried products. Some of the major destinations of these exports are the US, Japan, South Africa, Russia and the Philippines (National Farm Products Council, 2004).

Figure 1. Egg Imports and Exports in Thousands of Dozen from 1940 -2000



Source: Statistics Canada CANSIM, SDDS 3421 STC (23-202)

In the period of the 1940s to the 1950s egg exports from Canada were high (Figure 1) because Canada was the major exporter of eggs to Britain during the Second World War, however, when Britain stopped importing Canadian eggs, demand fell drastically. The market was plagued by instability until 1972 when the current supply management system was introduced (Agriculture and Agri-Food Canada, 2004b). Since then, egg exports have been increasing (Figure 1). Imports to Canada have been increasing since 1950.

Egg producers in Canada basically fall under two categories, unregistered and registered egg producers. For instance in Alberta, unregistered egg producers are those that have 299 or fewer layers while the registered egg producers are those that have more

than 299 layers (Alberta Egg Producers, 2004). It is worth noting that the actual limit of layers that can be owned by an egg producer before they are considered a registered egg farmer varies from province to province. Another distinction between the registered and unregistered egg producers is that the latter are subject to quotas (a discussion on how quotas are allocated is provided later in this chapter). A typical operation in Canada consists of approximately 17, 800 birds (Canadian Egg Marketing Agency 2004a). In 2003 there were 1101 regulated egg producers (Table 2). These egg producers provide slightly over 500 million eggs per annum from 20.2 million birds (CEMA, 2004). Table 2 shows the provincial and total number of registered egg producers in Canada from 2001 to 2003. In contrast to egg producers in Canada, in the United States the national flock laying size is approximately 280 million. Thus, one establishment in the US is capable of producing as many eggs as those produced by Canadian egg producers as a whole (CEMA, 2004).

Table 2. The Location and Total Number of Shell Egg Producers in Canada from 2001-2004

Province	2001	2002	2003	2004
British Columbia	138	133	132	127
Alberta	180	169	168	168
North-western Territories	2	2	2	2
Saskatchewan	67	66	66	64
Manitoba	174	171	167	168
Ontario	404	408	394	379
Quebec	109	111	107	107
New Brunswick	18	18	18	18
Newfoundland	15	12	11	11
Nova Scotia	24	24	24	24
P.E.I	15	14	12	11
TOTAL	**1146**	**1128**	**1101**	**1078**

Source: National Farm Products Council, 2002, 2003, 2004 &2005

1.1. Supply Management

The Canadian egg industry operates under a supply management system. Prior to the introduction of the supply management system, the egg industry developed stabilization programs and then provincial marketing boards in order to control production with the goal of dealing with the instability in the egg industry. However, the ability of the provincial boards was limited since they could not control inter-provincial movement of eggs. This limitation is what eventually led to the understanding that there was a need for a national body that could control or oversee the work of the provincial marketing boards. Thus, the supply management system present today came into effect on December 15th 1972 with the introduction of the Canadian Egg Marketing Agency (CEMA). The supply management system has legal authority under the Agricultural Products Board Act (1970) and the Farm Products Marketing Act (1972). The supply

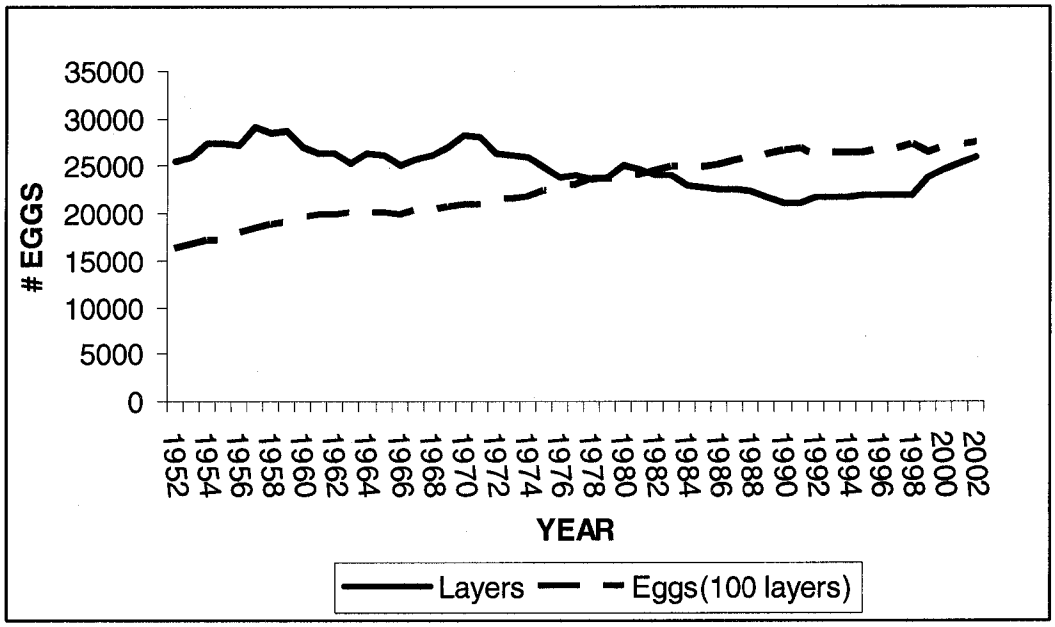
management system in Canada is made up of three pillars (1) production (quota) discipline (2) import control, and (3) producer pricing.

1.1.1. Production (Quota)

CEMA determines egg production on a national scale and allocates a percentage of the national production or quota[1] to each province based on historical production patterns. The provinces, through their respective provincial boards, in turn allocate these quotas to the poultry producers in their respective provinces. The production quota is allocated on number of birds and dozen of eggs. On average a laying hen will produce 24.4 dozen eggs per year. The average quota price per layer varies across provinces. The quota entitles the egg producer the right to sell all the eggs produced by one bird in each year at the price set by their respective producer board. Thus, a producer who has quota for 1000 hens will also have a production quota for 24400 dozen eggs. There are no penalties for over production (Alberta Government, 2004).

[1] The national quota has to be approved by the National Farm Products Council (NFPC). The NFPC was created by the Farm Products Marketing Act (1972) and was given the power to grant permission to groups willing to organize on a national basis. The NFPC is the body that deals mainly with the poultry and egg industries. It supervisors the activities of Canadian Egg Marketing Agency, Canadian Turkey Marketing Agency, Chicken Farmers of Canada, Canadian Broiler Hatching Egg Marketing Agency.

Figure 2. The Total Average Number of Layers and Total Eggs per 100 Layers for Canada



Source: Statistics Canada CANSIM, SDDS 3421 STC (23-202)

The information presented in Figure 2 shows that the average number of layers has been decreasing with time while the total number of eggs produced has been increasing with time. This trend in egg production is supported by a study by KPMG[2] that found that the typical hen had increased her egg production by 2.87% on less feed and less labour between 1994 and 1999(CEMA, 2004).

1.1.2. Import Controls

Another pillar of the Canadian supply management system is import controls. Canada was one of the participants and a signatory of the World Trade Organization agreement on agriculture that was concluded in December 1993 and came into effect on January 1st, 1995 (Agriculture and Agri-Food Canada 2004b). To honour the agreement,

[2] KPMG LLP is the Canadian member firm of KPMG International. KPMG has offices in Alberta, British Colombia, Manitoba, New Brunswick, Nova Scotia, Ontario and Quebec. KPMG provides audits, tax and advisory services with an industry focus.

Canada was required to change its existing agricultural quantitative import controls to a system of Tariff Rate Quotas (TRQ). The TRQs in Canada were legitimized by the General Agreement on Tariffs and Trade (GATT), Article XI (Agriculture and Agri-Food Canada, 2004). The TRQ allows for 5% of Canadian egg demand to be met by imports that come into the country duty free (CEMA, 2003). Egg imports that are over this level are charged an over-quota tariff[3]. The Canada Customs and Revenue Agency is responsible for the administration of tariffs.

1.1.3. Pricing Policy

The last pillar of the Canadian supply management system is producer pricing. In 1975 central selling of eggs was introduced along with a national monitoring system for hen numbers. However in 1993 the central pricing system was abolished and a decentralized system was introduced. This is the pricing regime that is present today (Canadian Egg Marketing Agency 2002). Thus, the prices that the egg producers charge for their egg products are set by the respective provincial marketing boards. The price formula adopted by the provinces consists mainly of two cost components: (1) costs based on provincial averages; and (2) costs based on national averages. The provincial costs include pullet costs, feed costs and labour costs, while the national costs include depreciation of infrastructure, plant and administration overhead, interest costs, a domestic levy for processing, an administration levy, and a grade A egg large conversion factor (Agriculture and Agri-Food Canada 2004a). The price of other eggs is determined based on the price spread from the grade A large egg price. The spread is established by

[3] An over quota tariff is a tariff applied on imports in excess of the quota volume.

CEMA and is based on the historical price spread between all the other egg sizes and the large grade A eggs.

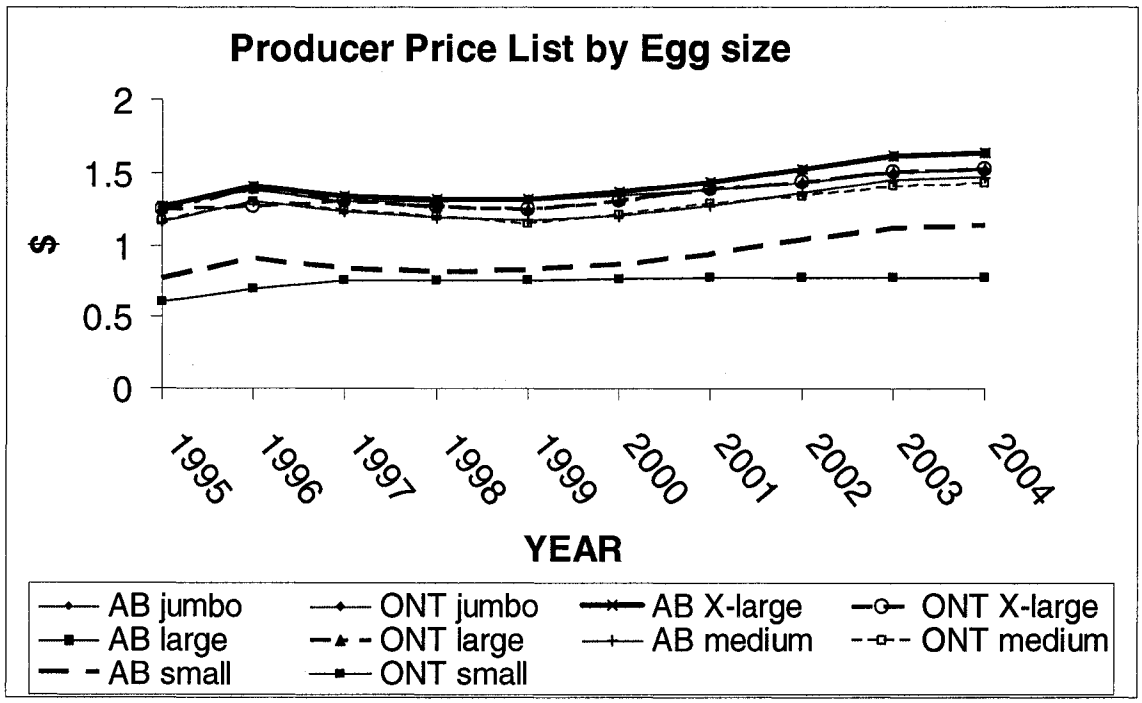
As for the non-normal eggs, the pricing is solely left to the producers and purchasers of the respective egg types. Additional costs may include flock management costs. Entailed in the flock management costs are the costs for special feed diets. For instance in order for a hen to produce at least 20 dozen omega 3 eggs, organic eggs, free range or vitamin enhanced eggs a producer needs high quality feed and lots of it (Henry, 2002). Also, in the case of free range eggs, free run eggs and organic eggs, barns have to be cleaned more frequently since the chickens have outdoor access (Henry, 2002). Also, the non-normal eggs tend to be packed in clear cartons which are more expensive as compared to the white opaque cartons that are often used. Also, non-normal egg producers face marketing costs as the selling of the respective egg types is solely left to the egg producer. If a producer plans to sell wholesale, even to local retail outlets, the eggs must be graded in a federally inspected facility and placed in a new carton with a product code also known as a UPC code (see Appendix 5. for the UPC codes for the products that were used in this study).

Most retailers have mark-up prices at which they buy the respective egg types from the producers. It is worth noting that the egg market is changeable and unique to each local area. In 2002 for instance free range eggs in the Maritime regions were selling for $2.00-$3.00/doz at the farm gate level. The retail price in this region was between $3.50-$3.80 (Henry, 2002). Woolley (2006) reports that in British Columbia normal/battery cage egg were selling at about 23 cents each, omega 3 eggs at about 25 cents each, free run eggs at about 30 cents each, free range eggs at about 39 cents each

and organic eggs were selling from anywhere between 40 to 50 cents each. Woolley reports that at the retail level organic eggs were going for $6.00/dozen. Henry (2002) also noted that in 2002 organic eggs were retailing at $4.99/doz. In 2005 in the Strathcona Farmers market located in Edmonton, Alberta, organic eggs were selling for about $4.00/doz and in the grocery stores the price was between $5.35-$6.00/doz (see Tables 4 and 5 for the retail prices of other non-normal eggs in two Edmonton grocery stores). In a Calgary Alberta market at Currie Barracks (farmers market) organic eggs were selling for about $4.50/doz. Prices in the grocery stores and other retail stores were higher.

The price of eggs sold to the breaker industry is determined in such a way that competition is feasible in the North American market. The reasons for this pricing strategy is mainly due to the fact that firstly a large number of domestic users of processed eggs could easily move production to the US, and secondly the users of processed eggs could easily adjust their inputs to exclude processed eggs. Thus, CEMA buys excess eggs from grading stations at the price that they paid to the producers and then sells them to the processing industry at a price that includes CEMA's handling cost, US/Canada exchange rate, the yield difference between US and Canada and the price they paid for the egg (Agriculture and Agri-Food Canada 2004b).

Figure 3. Average Prices of Eggs Sold Per Dozen by Producers from 1995-2004 in Alberta and Ontario



Source: Canadian Egg Marketing Agency (2005)

Figure 3 shows that there is little variation between the prices of shell eggs based on size. The only outstanding price is the one for small eggs in both provinces. From the graph it can be seen that the prices of small shell eggs in Alberta are higher compared to prices in Ontario.

1.2. New Trends and Product Developments in the Canadian Egg Industry

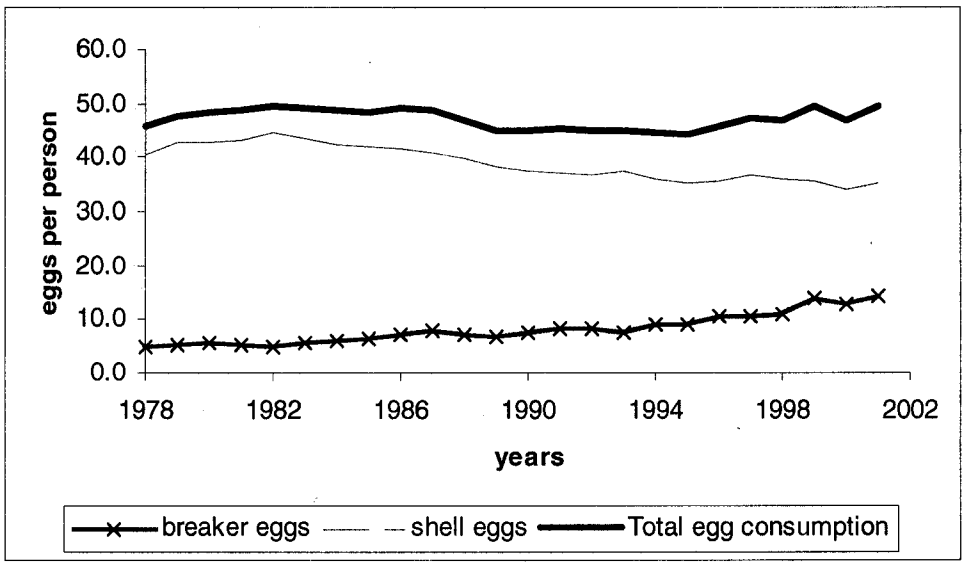
> *In the first half of this century it was regulatory programs which played a prominent role in developing the egg industry. In the 21st century it will be health control programs addressing human health, and their application throughout the production and marketing chain which will dominate the egg industry in Canada.*
>
> (Agriculture and Agri-Food Canada 2004b, p4)

"If we stand back and look at the appalling incidence of cancer, sterility, developmental and inherited abnormalities of humans, we find a common thread. The answer not in the stars or in genes, but how our genes are affected by the contaminated food we eat, the water we drink and the air we breathe".

(Fox 1992, p88)

Aside from health control programs, consumer concerns about health and nutrition, animal welfare and the environment may be influencing the Canadian egg industry. These consumer concerns may be causing a decline in shell egg consumption, substitution for breaker egg products and/or an increase in demand for egg substitutes.

Figure 4. Canadian Per Capita Egg Consumption from 1978 to 2002



Source: Statistics Canada CANSIM, SDDS 3421 STC (23-202)

From Figure 4, it is evident that the share of shell eggs consumed as compared to that of breaker eggs has been declining with time while the share of breaker eggs has been increasing over time. Thus, consumers may be substituting breaker egg products for shell eggs because they are more convenient and also because they are used as

components in other foods such as mayonnaise. A report by the Alberta Government (2004) states that due to changes in the domestic market for eggs the percentage of domestic production necessary to meet the increased demand for industrial products (processed eggs) increased from 18% in 1997 to 23% in 2002. Also, shell egg demand may have been negatively affected by the widely publicized link between cholesterol and heart disease. However, in 1999 a Harvard study supporting the consumption of eggs concluded that eating 7-14 eggs per week did not increase the risk of heart attack or stoke in healthy adults (Hu et al., 1999). Positive information from articles such as the one mentioned above might be contributing to the slight increase in the per capita shell eggs consumed. EL Hafid (2004) notes that the market for functional foods and nutraceuticals (FFN) is being driven by growing understanding of diet/disease links, aging populations, rising health care costs, and advances in food technology and nutrition.

1.2.1. Food safety issues

The recent outbreaks of animal transmitted diseases such as BSE, Avian flu and Newcastle disease, advancements in biotechnology and genetic engineering and food borne illness scares such as *E. Coli* and Salmonella catalyzed by increased media coverage have influenced and increased consumers awareness of food safety issues in the livestock industry (Hoskins, Jordan, and Kolodinsky 2004; Thilmany, Umberger, and Ziehl 2004). Numerous Canadian polls show that consumers are concerned about food safety and they consider safe food to be an important food quality (Reid, 2005). A poll by Angus Reid in 2001 showed that overall concern for food safety had increased to 74 % among Canadians from 1991 to 2001 (Chicken Farmers of Canada 2004).

Canadian poultry farmers have responded by developing on-farm food safety programs. The origin for the Start Clean-Stay Clean program can be traced back to 1990 when CEMA launched the "Safe from Salmonella" program. This program was launched after scientists in Europe and North America discovered that Salmonella Enteriditis could survive inside an egg and eventually be transferred to human beings through consumption. Salmonella was particularly prevalent in Britain because the norm was not to refrigerate eggs. Though this problem was not present in Canada, CEMA felt that the "prevention is better than cure" approach was the way to go. Thus, CEMA consequently launched the Safe From Salmonella program to educate farmers about the need to develop security measures on-farms in order to reduce the likelihood of dangerous bacteria in eggs (Canadian Egg Marketing Agency 2004b).

The Start Clean-Stay Clean program was recognized in 2004 by the Canadian Food Inspection Agency as a technical Hazard Analysis Critical Control Points (HACCP)[4] based program (Canadian Egg Marketing Agency 2004b). The goal of the program was to identify risks and take necessary steps to prevent problems. Once a problem is identified, the program can be designed in such a way that the source of the problem is identified and consequently solved. Thus, the general framework of HACCP involves seven principles: (1) analyze hazards, (2) identify critical control points, (3) establish preventative measures with critical limits for each control point, (4) establish procedures to monitor the critical limits for each control point, (5) establish corrective actions to be taken when monitoring shows that a critical point has not been met, (6)

[4] In Canada, federally registered fish and seafood processors are the only establishments required by regulation to have HACCP in place. In addition meat slaughter establishments exporting to the U.S are required to have HACCP in place in order to maintain access to the U.S market. Many sectors such as the processed fruit and vegetable, shell and processed eggs, hatcheries, dairy, honey and maple syrup have or are in the process of implementing HACCP principles voluntarily (Food Safety Network, 2005).

establish procedures to verify that the system is working properly, and (7) establish effective recordkeeping to document the HACCP system.

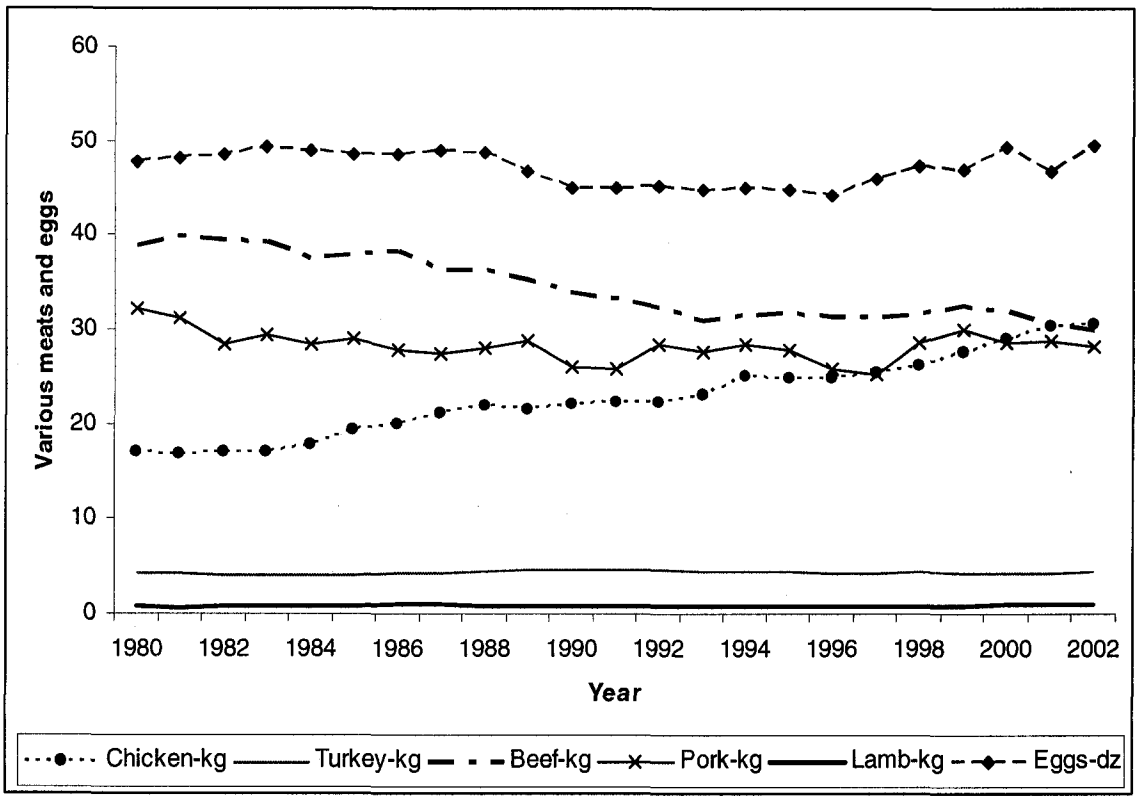
Initially, all regulated egg farms in Canada were inspected by CEMA's field offices according to criteria for the safe production of eggs introduced in 1990. This has however been redesigned and is now currently based on the HACCP principles. Today, any egg producer who receives 90% or more on their Start Clean-Stay Clean program receives a Certificate of Achievement (Canadian Egg Marketing Agency, 2004b). It should be noted that Start Clean-Stay Clean is a voluntary program. However, due to the growing consumer concern towards food safety the egg industry is interested in maintaining and improving its commitment towards producing safe food. Thus, exploring whether consumers are willing to pay for food produced with extra food safety measures or standards is one way to facilitate this.

1.2.2. Nutrition

There has also been increased general public awareness of the relationship between diet and lifestyle related disease (Urala, Arvola, and Lahteenmaki 2003). This concern has led to increased consumer scrutiny of traditional nutritional aspects of food such as cholesterol fat, fibre, salt and vitamin content and non-traditional nutritional attributes of food such as omega-3 content and vitamin enhanced foods. For instance, there is currently a trend towards low carbohydrate diets such as the Atkins and South Beach programs. Although it is not known how many Canadians are following the Atkins diet, The NPD Group, a provider of global sales and marketing information, reports that in 2004, approximately five percent of Canadians were on some form of low carbohydrate diet. NDP also reports that approximately 19% of Canadian adults were on

diet. (NDP Group 2005). These trends may have had an impact on egg consumption and the consumptions of other sources of protein (Figure 5).

Figure 5. Canadian Per Capita Consumption of Different Protein Sources from 1980 to 2002



Source: Statistics Canada CANSIM, SDDS 3421

From this graph it can be seen that the consumption of beef has been declining while the consumption of eggs and the other meats have maintained a steady consumption pattern. The reason for the steady egg consumption may be due to an increase in the demand for processed eggs (liquid and dried) which offset the decline in the consumption of shelled eggs. The decline in shell eggs could be explained by increased consumer concerns about health related issues such as heart diseases, cancer, nutrition, weight, exercise and diabetes mellitus (Peng, 2004).

To combat these concerns, the Canadian egg industry has intensified campaigns on the health benefits of eggs by publicizing research questioning the link between egg consumption and cholesterol levels. For instance numerous studies have found that consumption of one egg per day may have no impact on a person's cholesterol level provided they do not consume other foods high in cholesterol (Meister 2002; Herron and Fernandez 2004). Meister confirms that scientific studies completed in 1996 validated and strengthened the conclusions that dietary cholesterol has only a small effect on blood cholesterol and that little if any relationship exists between egg consumption and heart disease risk. In Canada, shell eggs are found to meet the criteria for the Health Check program. Health Check is a national program that was developed by the Heart and Stroke Foundation of Canada to help Canadians identify health foods and also make healthy food choices.

1.2.3. Animal welfare

> *There is an increasing awareness that currently accepted moral standards of our society call for the prevention of any avoidable suffering. Domestication and artificial selection have made farm animals dependent on humans. Consequently, according to the existing principles of ethics, humans must accept this dependence as a commitment for humane conduct toward domestic animals in all stages of their life.*
>
> (Canadian Agri-Food Research Council 2003, 1)

Animal welfare is yet another pressing issue that has had an impact on consumer's preference for livestock products. Concerns specific to egg production are forced molting, beak trimming, and housing. These concerns are meant to encourage the

adoption of better animal husbandry practices in the livestock industry. It should be noted, however, that with regard to enforcing ethical animal husbandry practices, some countries are more stringent than others in their policies. Appleby (2003) for instance notes that the European Union has pushed and instituted a legislation that will see an end to use of conventional laying cages by the year 2012. Appleby further notes that the first European Symposia on Poultry Welfare was held in 1977 while in North America the first symposium on animal welfare was held in 1995 in Edmonton, Alberta, Canada.

This revelation however should not completely underscore North American residents concern for animal welfare, as some of their major fast food restaurants, McDonalds, Wendy's, KFC and Burger King, have put forward welfare requirements with regard to poultry production methods for their egg and meat suppliers. These varying policies and consumer views with regard to animal welfare reflect the fact that there is a lack of consistent information on the influence animal welfare has on the consumer's perceptions of food quality and purchasing habits (Fearne and Lavelle 1996; Appleby 2003; Schroder and McEachern 2004).

Another major component of CEMA's on-farm work is the Animal Care program. This on-farm program is based on the Canadian Codes of Practice for the Care and Handling of Farm Animals developed and revised by the Canadian Agri-Food Research Council. It should be noted however, that these codes of practice are not standard for all animals. Each industry has a code of practice that is specific to it. The codes are voluntary and are intended to be used as an educational tool in the promotion of sound husbandry and welfare practices. They contain recommendations to assist farmers and

others in the agriculture and food sector to compare and improve their own management practices.

In 2003 the original code of practice for poultry was revised and a new code of practice for the care and handling of pullets, layers and spent fowl was introduced (Canadian Agri-Food Research Council 2003). These codes are solely based on scientific principles. Some of the issues that are being dealt with regards to animal cruelty are: beak trimming, space requirements, and disposal of spent layers. Thus, farmers are inspected based on 14 criteria pertaining to density (bird weight), water and feed, beak trimming, house temperature, air quality, molting, generators and layer condition. The retailer and restaurant sectors are encouraging producers to develop common verification systems, such as the industry's Animal Care Program. Otherwise retailers and food chains may develop their own animal welfare purchasing specifications, thereby forcing producers to abide by different criteria depending on who they supply (Canadian Egg Marketing Agency 2004a). Examples of food chains that have already set up such guidelines include companies such as KFC, Burger King, McDonald's and Wendy's. Each company has animal welfare codes and third party auditing systems in place that are requirements for all their egg suppliers in Canada and the US (Babcock et al., 2002). Since adopting these various programs implies increased costs for consumers, there may be disinterest on the farmer's part. However, if there was evidence that the consumers are willing to pay for products that are geared towards addressing animal welfare issues, farmers may be more willing to participate in such programs.

1.2.4. Environmental concerns

The impact of human activities on the environment has become a very contentious issue today due to the close relationship between livestock production operations and the environment. For instance, it has been noted that 54% of US consumers check labels for environmental information. Also, research from numerous Organization of Economic Cooperation and Development (OECD) countries found that consumers are willing to pay for goods that are more environmentally friendly (Salzman 1991). These concerns are motivated by increased environmental awareness (e.g. greenhouse gases and global warming) among consumers, the extensive coverage of the impact of livestock operations on the environment, and by the uncertainty of the effect of many of these pollutants on the open environment (Pillai and Ricke, 2002). Focus is shifting to potential environmental risks and consequences of the various livestock practices and production techniques (Alberta Government 2004). "Potential impacts associated with poultry production and consequently livestock production include transmission of pathogenic and zoonotic diseases, soil erosion and compaction, disposal of excess nutrients and water, and ground water contamination" (Alberta Government, 2004).

Product development

Over the last 20 years, there has been a proliferation of different types of shell eggs namely omega 3 eggs, organic eggs, vitamin enhanced eggs, free run eggs and free range eggs. These shell eggs can be characterized as follows (1) nutritionally enhanced such omega 3 and vitamin enhanced eggs, (2) value-added such organic, free run and free range eggs, and (3) added processing such dry and liquid eggs. Eggs characterized as nutritionally enhanced are produced by hens that are fed with modified feed content. The

value-added egg products are defined as eggs that were produced in an animal friendly or safe or environmentally friendly environment. A definition of the shell egg products available in Canadian grocery stores are provided below.

Table 3. Types of Value-Added Egg Products Available at Most Canadian Grocery Stores

Type of Egg	Definition	Addressed Issue
Omega-3	Hens are fed with diets that contain 10-20 percent of flax seed. Thus these eggs are rich with omega three polyunsaturated fatty acids.	Nutrition and dietary concerns
Vitamin enhanced	Hens are fed with a diet rich in vitamins E, folate, B6, and B12. The amount of vitamins included in the egg may vary based on the various brand names.	Nutrition and dietary concerns
Organic	Comes from hens that are fed with a special feed that have ingredients that were grown without pesticides and herbicides. These eggs have the same nutritional value as the normal eggs.	Food safety, health and environmental concerns
Vegetarian	These hens are fed on a diet containing ingredients of plant origin only. These eggs have the same nutritional value as the normal eggs.	Dietary concerns
Free Run	These eggs have the same nutritional component as the normal eggs and are from hens that have access to the floor of the barn, nesting boxes and possibly perches.	Animal welfare concerns
Free Range	These eggs have the same nutritional component as normal eggs. The difference between these eggs and the free run eggs is that these layer hens have access to the outdoors whenever the weather is conducive.	Animal welfare concerns

Clearly, it can be argued that the shell egg industry is tending towards more product differentiation. This claim is supported by the observation of the Chairman of the Canadian Egg Marketing Council that "Not only did sales volume rise three per cent in

2001 but sales dollars rose nine per cent indicating that Canadians are trading up to value-added eggs...brown eggs, omega-3 eggs and organic eggs are doing well" (Saskatchewan Agriculture and Food 2005).

The problem with a differentiated system is that consumers may get confused and overwhelmed by the many products. Evidence of the potential confusion that this may be occurring is shown by the divergent range in prices for similar egg products that were collected from two major grocery stores in Edmonton, Alberta on September 9, 2004.

Table 4. Shell Egg Prices from a Save-on-Foods Grocery Store

Company name	Specialty	Egg size	Price/dozen ($)	Colour
Western Family	Normal	Extra large	2.15	White
Western Family	Normal	Small	1.55	White
Western Family	Normal	Medium	1.85	White
Western Family	Normal	Large	2.25	Brown
Western Family	Normal	Large family pack	1.99	White
Western Family	Normal	Large	2.04	White
Western Family	Normal	Large	2.09	White
Naturegg Prestige	Normal	Large	2.55	White
Naturegg Natures Best	Vitamin-enhanced	Large	2.75	White
Naturegg	Free run	Large	3.30	White
Naturegg	Omega-3	Large	2.92	White

Table 5. Shell Egg Prices from a Safeway Grocery Store

Company name	Specialty	Egg size	Price/dozen($)	Colour
Lucerne	Normal	Medium	1.85	White
Lucerne	Normal	Large	2.09	White
Lucerne	Normal	Extra Large	2.15	White
Safeway/Lucerne	Normal	Jumbo	2.25	White
Lucerne	Normal	Large	2.19	Brown
Safeway/Lucerne	Normal	Large	1.99	White
Lucerne	Normal	Jumbo	2.33	White
Safeway/Lucerne	Normal	Small	1.55	White
Sho White	Normal	Medium	1.78	White
Sho White	Normal	Large	1.99	White
Safeway	Normal	Large	2.18	White
Naturegg	Omega-3	Large	2.92	White
Naturegg	Free-Run[5]	Large	3.78	White
Dr. Sims Designer Egg	Omega-3	Large	2.69	White

There are also numerous studies (Korthals 2001; Cason and Gangadharan 2002; Harper and Makatouni 2002; Sunding 2003; Urala et al., 2003) that support the claim that consumers are confused about product differentiation. Other studies have shown that consumers are willing to pay premiums for products that are geared towards their specific preferences. These premiums are sometimes motivated by health claims and benefits (Dixon and Shackley 2003); increased environmental awareness and stewardship

[5] Note only free run eggs are include in this table because free range eggs are only produced in the summer when the whether is conducive for hens to be let outdoor.

(Loureiro et al., 2002); and concerns for animal welfare and their links to product safety and quality (Egbert et al., 2003).

Thus, it can now be argued that the increased emphasis on food quality, health and diet, animal welfare and environment are partly supply driven, as a result of technological changes. The increased emphasis is also partly demand driven shown by increased consumer interest in a wider variety of intrinsic and extrinsic food attributes. Reynolds-Zayak (2004, 5) best summarizes the new trend in consumer preference when states that "consumers are searching to define their personal eating lifestyles through revising their thinking about food and mixing and matching various foods characteristics to find the ideal combinations for themselves and their families".

This thesis will provide information on consumers' revealed preferences for the differentiated value added shell egg products in the Alberta market. The assumption is that observed behaviour in the market is the best indicator of preferences. Also, the level of noise does not always indicate size of opportunity. Thus, understanding how consumers are responding to the various egg products is warranted since adopting most of the production methods described above imply increased costs to the producers. Most of the studies that have looked at the above issues have used the stated preference method and have not been conducted in Canada. Very few studies have used the revealed preference method.

1.3. The Economic Problem

The agri-food sector and particularly the Canadian egg industry continues to show structural shifts with some of the changes being reflected by the proliferation of specialty and designer shell eggs (such as omega-3 and vitamin-enriched eggs, vegetarian

and organic eggs, free-run and free-range eggs) in the Canadian egg market and the involvement of egg producers in the Start Clean-Stay Clean Program.

Martin (2000) argues that this structural change is being driven by at least three major factors. The first factor that is identified and is important from a commercial perspective is the changes taking place in product demand. Specifically, consumers may be demanding products that are geared towards addressing their concerns with regards to health, nutrition, animal welfare and environmental stewardship.

The second factor is change in technology. In the egg sector this can be seen through the development of new products such as vitamin enhanced eggs or powdered or liquid egg products. Other technological changes could be with regard to packing and storing of eggs. Consumer preferences will ultimately drive the success of new shell egg and breaker egg products.

The Canadian egg industry is aware of many diverse market segments based on the lifestyle, household size, age, environmental process, health concerns (fat, fibre content, pesticides, GMOs, chemicals other than pesticides, specific nutrient/ingredient) and/or animal welfare. There have been no studies conducted examining the attitudes of Canadian consumers towards specialty and value added shell egg products and yet it is evident that egg processors and producers feel there is a demand for differentiated egg products on a number of different categories, as is shown by the fact that they provide shelf space for a large variety of egg products. The different egg products or types provide consumers with alternatives which in turn may lead to increased competition. However, if consumers show very little willingness to shift their purchasing patterns among the different egg products, the potential for competition may be minimal. The

degree of consumer egg product selection is likely tied to the attributes of the egg product and to the characteristics of consumers or households. Understanding how prices and marketing strategies affect consumer choice behaviour for a specific egg type assists industry planners and retailers in determining the optimal price and promotion policies. Also, knowledge of how choices vary by household characteristics is relevant to predicting consumer trends.

Thus, changes in demand can affect the entire supply chain. It introduces a set of strategic decisions that producers and processors must make as they evolve. What products do people buy? Who are our customers? From whom will people buy? What products do we sell and how do we maintain our competitiveness? The information obtained from this study is beneficial to the egg industry as there will be increased knowledge of demand preferences for the various differentiated egg products. The industry will also obtain information on whether there is room for more product differentiation. The egg producers will gain knowledge of the extent of the substitutability of the various eggs products given the fact that the adoption of the various programs imply increased production costs and consequently increased prices. The retailing sector and processors could benefit by being able to predict sales and the future trends in egg product demand.

The second problem is that most of the studies that have looked at consumer demand or preference for goods or commodities that are socially responsible have mostly used stated preference methods. Very few studies (e.g. Baltzer 2004) have used revealed preference methods. This is a problem because what consumers say is not what they necessarily do. This is often referred to as the hypothetical bias problem. Thus, this study

will benefit the current research base by providing revealed preference estimates on consumer's willingness to pay for products that have animal welfare, food safety, nutrition and environmental attributes. The assumption is that observed behaviour is the best indicator of consumer's preferences and consequently will provide more accurate measures of willingness to pay for these attributes.

1.4. Objectives

The first objective of this thesis is to provide a better understanding of the developments in the food marketing system and the consumer valuation of new egg products and product attributes. An evaluation of consumer egg preferences on egg choices based on economic and other social characteristics such as family size, number of children, gender, and income with specific attention to specialty and designer eggs that have environmental, health, animal welfare or food safety claim will be conducted. In order to empirically address egg choices, the following analysis will be limited to shell egg choices and processed eggs will not be included. Thus, using individual consumer household purchasing data, trends in the selection of egg choices will be shown with shell eggs defined as: (1) normal eggs, (2) omega-3 eggs, (3) free range/free run eggs, (4) organic eggs, and (5) vitamin enhanced eggs. This information will consequently be used to make recommendations for planning and policy analysis within the egg industry.

The second objective is to estimate the consumer's willingness to pay for products that have environmental, food safety, nutrition and animal welfare attributes with the goal of developing marketing and pricing strategies that could be adopted by the Canadian egg industry.

1.5. Organization of the Study

In Chapter 1 an overview on the structure of the egg industry and developments in the egg industry are discussed. This is followed by a brief discussion on consumer concerns, followed by a presentation of the economic problem, objectives, and organization of the study.

In Chapter 2 an extensive literature review examining the economic theory relevant to the current study is outlined. This will be followed by a discussion of some of the previous egg studies done in Canada. A discussion on revealed and stated preference is also outlined. Lastly, some of the previous studies other than those within Canada dealing with similar issues are discussed.

In Chapter 3 the theory of choice, the foundation of choice models, the random utility theory and multinomial logit model and nested logit are discussed. In Chapter 4, information on the data to be used for the analysis and the hypothesis are presented and discussed. Presented in Chapter 5 are the results from the analysis from the nested logit model and the multinomial logit model. The results are consequently used to generate willingness to pay estimates. The estimates from the conditional logit model and willingness to pay estimates are also discussed in Chapter 5.

In Chapter 6 conclusions, market implications and limitations of this thesis are presented.

Chapter 2 Literature Review

2.0. Introduction

In order to achieve the goals outlined in the previous chapter, this study on the Canadian egg industry requires an understanding of the various factors surrounding demand analysis. Determining the willingness to pay and demand for the various egg products requires an exploration of consumer theory. Different types of analyses such as time series versus cross-sectional or cross-sectional versus longitudinal/panel or time series versus longitudinal/panel are discussed. Previous studies both in and outside Canada dealing with similar issues with emphasis on egg studies are also presented. The economic concepts of value, methods of measuring value (i.e. via stated and revealed preference methods) are discussed and a brief overview on product differentiation is also presented. Thus, this chapter attempts to create a strong theoretical foundation for the methods employed in the estimation of egg demand.

2.1. Economic Consumer Theory

Consumer theory is a framework that allows one to translate assumptions about preferences for goods or services into demand functions that reflect the behaviour of consumers in particular situations. In economics these assumptions are normally based on the assumption of utility maximization. This means that if an individual is free to decide his/her actions, it is reasonable to believe that these individuals will choose to consume a commodity they find gives them pleasure (utility) and not consume that which they dislike (Varian 1999).

2.1.1. Understanding the Theory of Choice

Any given choice can be seen as an outcome of a sequential decision making process by an individual, household or firm (Ben-Akiva and Lerman 1985). Ben-Akiva and Lerman argue that the theory of choice consists of the following elements: (1) the decision maker (2) the alternatives (3) the attributes of the alternatives, and (4) decision rule.

First, a decision maker can either be an individual, household, firm or a government agency. Thus, the concept of "individual" may easily be extended depending on the particular application. Consequently, we may consider that a group of people the decision maker. By doing so, all internal decisions within a group are ignored and the group is looked at as one entity. Ben-Akiva and Lerman (Ben-Akiva and Lerman 1985) argue that by considering a group of individuals as a single decision maker the interactions of household or firm are simplified. Thus, "decision-maker" and "individual" will be used interchangeably throughout this thesis. This assumption helps define who the decision maker is, and what their characteristics are.

Secondly, analyzing the choice of a decision maker requires the knowledge of what has been chosen, and also of what has not been chosen. Thus, assumptions need to be made about the alternatives that were considered by the decision maker to perform the choice. The set containing all the alternatives is referred to as the choice set. An individual makes a choice from a nonempty set of mutually and collectively exhaustive alternatives which are affected by his/her environment also known as the universal set of alternatives (Ben-Akiva and Lerman 1985). From this universal set, a decision maker considers their choice set which is a subset of the universal set. This set consists of all

alternatives that are available and known to the decision maker. Thus, in order to model discrete choice models, two concepts of a choice set have to be considered: (1) the universal choice set and (2) the reduced choice set.

The universal choice set contains all the available alternatives in the context of the application. In this context, the universal set will contain all the potential egg products such as omega-3, vitamin enhanced, free run, free range, normal, and organic. The reduced choice set is a subset of the universal choice set considered by a particular individual. Thus, alternatives that are not available in the universal set that are not available to the individual under consideration are excluded. Every alternative in a choice set must be characterized by a set of attributes. Thus, a researcher has to identify the attributes of each alternative that are likely to affect the choice of the decision maker. In the context of differentiated egg products, the list of attributes for an omega-3 egg may include price and nutrition. It should be noted that some attributes may apply to all the alternatives, while some may be specific to one alternative. As well, an attribute is not necessarily a directly observed quantity or quality.

Before analyzing the choices of a consumer, assumptions about the rules used by an individual to come up with the actual choice need to be discussed. A discussion on the neoclassical economic theory will be used to introduce the concept of utility which is a necessary tool in helping understand individuals' choices.

2.2. Neoclassical Economic Theory

Neoclassical economic theory assumes that an individual is able to compare two alternatives a and b in a choice set C using a preference indicator ($\succeq$). If $a \succeq b$, the individual is assumed to either prefer a to b or they are indifferent. Thus, based on the

neoclassical economic theory, the preference indicator should have the following properties:

*1) **Transitivity:*** $a \succeq b$ and $b \succeq c$ then $a \succeq c \ \forall a,b,c \in C$. Meaning, If a is preferred to b and b is preferred to c then a will be preferred to c given that a, b and c are elements in set C.

*2) **Reflexivity**:* $a \succeq a$, $\forall a \in C$. Meaning that a commodity is as good as itself.

*3) **Comparability**:* $a \succeq b \text{ Or } b \succeq a$, $\forall a,b \in C$ Commodities can be compared to each other and one commodity is as good as the next one.

Since the choice set C is known or finite, this means that there exists an alternative which is preferred to all the available choices. Consequently, this means alternatives can be ranked. Thus, because of the above properties, it can be shown that there exists a function:

$$U : C \rightarrow \Re : a; U(a) \tag{2.2.1}$$

Such that:

$$a \succeq b \Leftrightarrow U(a) \succeq U(b) \ \ \forall a,b \in C \tag{2.2.2}$$

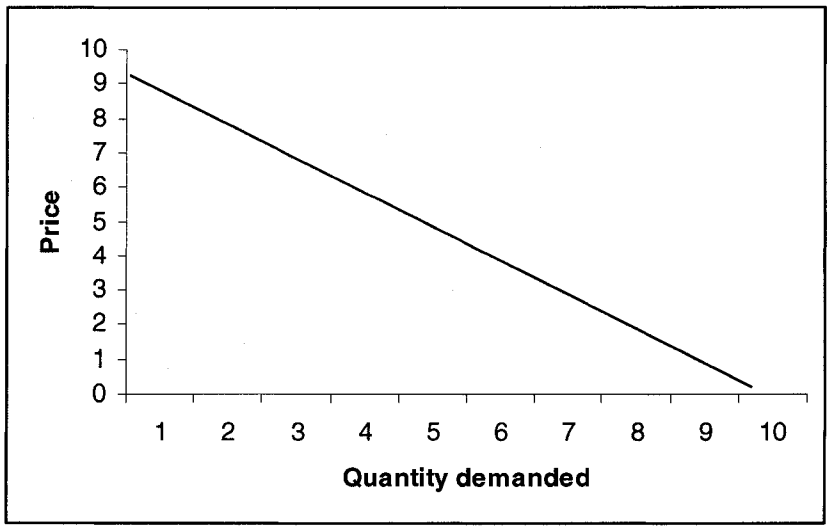
This means that if a is preferred to b then the utility obtained from a is higher than the utility obtained from b. Thus, using the preference-indifference indicator to make a choice can be viewed as the equivalent of assigning utility to each alternative, and then selecting the alternative associated with the highest utility. Utility is viewed as the measure of attractiveness of a given alternative. Thus, the attraction of an alternative in terms of its attributes can be expressed by a single objective function. The single nature of the objective function allows for the compensatory offsets or trade-offs by the decision maker when comparing attributes (Ben-Akiva and Lerman 1985). This implies that given

a choice of alternatives with distinct utilities, the decision maker will always select the alternative with the highest utility. The underlying assumption behind this choice process is the notion that the decision maker is rational. Rationality in economic consumer theory refers to a decision maker with consistent and transitive preferences who under similar circumstances will repeat the same choice. The importance placed on hypothesis of utility maximization is due to the fact it can be used in the development of models that can predict human behaviour. Consequently, this leads to the formulation of choice processes that can be used for mathematical analysis and in statistical applications.

2.2.1. Understanding the Demand Curve

The main goal of consumer theory is to describe the factors that determine the amounts spent by a household/consumer on available goods and services and to determine the factors that influence these decisions. In order to construct the demand curve all possible consumers and their reservation prices must be considered. The reservation price is defined as the maximum amount of money an individual would be willing to accept and still buy a particular commodity or service. In the figure below the horizontal axis shows the quantity an individual will purchase while the vertical axis shows the reservation prices.

Figure 6. Demand Curve/Willing to Pay Locus



Source: (Varian 1999)

In the above scenario, if the market price for this commodity was set at 9 dollars, there will be zero quantity bought because individuals are not willing to pay such a high price. Now if we assume that there are a number of consumers for this particular commodity/good/service then the darkest line also known as the demand curve or willingness to pay locus will straighten out (Note: the demand can also be non-linear). Thus, the demand curve relates the price of a good to the quantity demand and shows how consumers are willing to pay for particular goods. The shape of the demand curve implies that the lower the price is the more consumers will demand the good *ceteris paribus* (Varian 1999).

The price of a commodity is not the only factor that determines its demand. Other important factors include consumer's specific preferences towards the good, prices on substitutes, prices on complements, and income level. A change in either one of these

factors will result in the shift of the demand curve either up or down. A simple demand function for omega 3 eggs may have the following expression:

$$Q_{omega3} = f(P_O, P_S, P_C, I) \tag{2.2.3}$$

where Q_{omega3} is the total quantity demanded of omega-3 eggs which are assumed to be non-negative continuous variables (note: there are instances where these quantities are assumed to be discrete variables in the sense that consumption of one or more of the goods may be zero), P_o is the price of omega-3 eggs, P_s is the price of substitutes such as normal eggs or organic eggs, P_c is the price of complements which could be toast/bread, and I represents the income level.

Elasticity shows the sensitivity of demand to changes in any of the explanatory variables. This is done by comparing the relative change in one factor in relation to relative changes in another factor. Price elasticity measures how changes in the price of good changes with respect to itself and other goods. This price elasticity is calculated by dividing the percentage change in demanded quantity with the percentage change in the price multiplied by the ratio of price to quantity. Income elasticity for a good or service is calculated by dividing the percentage change in quantity demand with the percentage change in the income level. A good is assumed to be a normal good when the income elasticity is positive and inferior when the income elasticity is negative.

In empirical research, researchers often start from specified direct or indirect utility functions $U(.)$ which are not observable, to obtain indirect utility functions $V(.)$ at the given price and income levels. These utility functions are then used to develop a system of demand equations. Thus, in empirical analysis, where parameters of demand

functions are estimated from data on various consumers, it is important to specify how utility functions vary among consumers apart from the effects of prices and income. This variation is due to preferences and socio-economic characteristics and these are thus incorporated into demand estimation. Random error terms are incorporated in the analysis to account for the effect of unobserved influences and measurement error on predicted choices.

A utility function is a function that assigns a number to every consumption bundle. Specifically,

$$u = u(Q, S, T) \tag{2.2.4}$$

where Q is a vector of the quantities of the market good, S is a vector representing individual preference, T is a vector of the times spent in various activities that yield utility to the individual. This utility function is assumed to be increasing in all arguments, unique up to a monotonic transformation, and for mathematical purpose the utility function is assumed to be continuous, convex and twice differentiable (Freeman 2003). This type of utility is referred to as ordinal utility since it is non-additive and unobservable.

For simplicity purposes let it be assumed that an individual's utility is only a function of private goods that are bought and sold in a market. Thus it is assumed that an individuals tastes and preferences are given and do not change. Thus, an individual is assumed to face a set of given prices for a good/services and is assumed to choose the quantities of the good/ services so as to maximize his/her utility, given prices and income M . The maximization problem is expressed as:

$$\text{Maximize } u = u(X) \quad \text{Subject to } \sum^{i} p_i.x_i = M \tag{2.2.5}$$

Where X is the vector of quantities $(X = x_i ... x_n)$. The solution to this problem gives ordinary demand functions also known as Marshallian demand functions:

$$x_i = x_i(P, M) \tag{2.2.6}$$

Where P is the vector for prices:

$$(P = p_i, ..., p_n) \tag{2.2.7}$$

Substituting the expressions for x_i as functions of P and M into the direct utility function $(u = u(X))$ gives the indirect utility function that is an expression of prices and income, assuming optimal choices of goods:

$$u = v(P, M) \tag{2.2.8}$$

Roy's identity states that the demand functions can be expressed in terms of derivatives of the indirect utility functions as is shown below:

$$x_i(P, M) = \frac{(dv / dp_i)}{(dv / dM)} \tag{2.2.9}$$

The expenditure function presents a useful take on the problem of individual/consumer choice. The expenditure function is obtained by creating the dual of the utility maximization problem; only that in this case the individual is assumed to minimize total expenditure subject to a constrained utility level attained.

$$e = \sum^i p_i . x_i \tag{2.2.10}$$

$$u(X) = u^0 \tag{2.2.11}$$

Here u^0 represents the maximum utility attained and

$$u(X) = u(x_1, ... x_i ..... x_{n)} \tag{2.2.12}$$

The solution to this problem yield a set of functions giving optimal quantities for given prices and utility. Substituting these demand functions into the expression of total expenditure:

$$e = \sum^{i} p_i . x_i \tag{2.2.13}$$

gives the expenditure function. This expression shows the minimum dollar expenditure needed to attain a specified utility, given market prices.

$$e = e(P, u^0) \tag{2.2.14}$$

Where e is the dollar expenditure and u^0 is the specified utility level. The compensated or Hicksian demand functions can be obtained by differentiating the expenditure function with respect to each of the prices. This derivation is commonly referred to as Shephard's Lemma.

$$\frac{de}{dp_i} = h_i = h_i(P, u^0) \tag{2.2.15}$$

Where h_i is the compensated or Hicksian demand for x_i.

The above problem shows that the demand functions can be derived interchangeably given the problem a researcher is faced with. This above exercise has shown the duality condition that exists in the estimation of demand. This duality feature of demand functions helps researchers to estimate the demand that describes the individual's response to changes in prices and income given observed individual behaviour. Thus, systems of demand can be integrated to yield the expenditure functions, which in turn can be used to derive the indirect and direct utility functions (Freeman 2003). Since utility functions are not directly observable, demand researchers are often

faced with a problem of choosing the right functional form that can best model consumer behaviour.

Table 6. Summary of Consumer Demand Theory

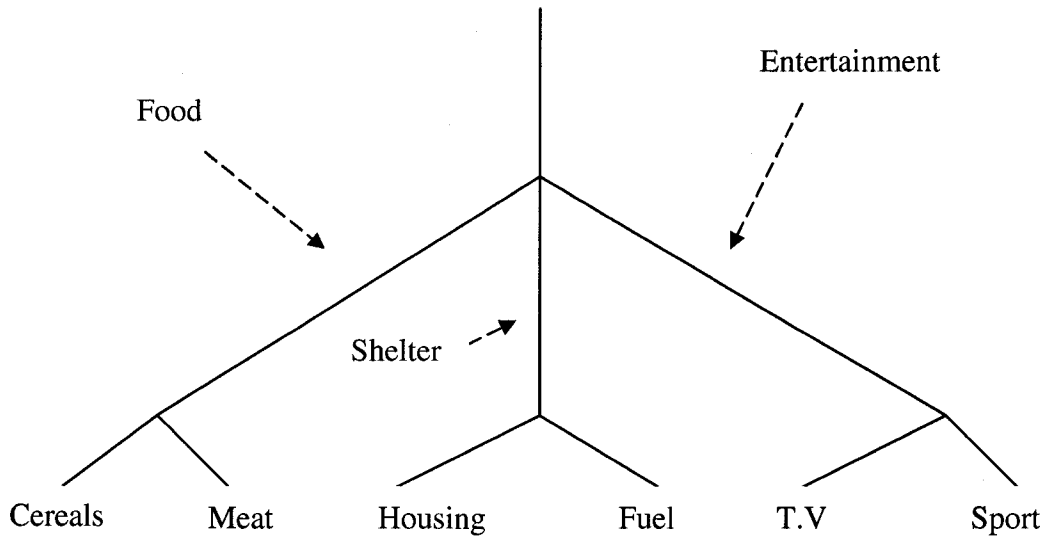
Income (M) or budget		Consumer expenditure Function E (U, p).
	=	Using Shephard's Lemma Hicksian demand functions are obtained
Marshallian demand x(M,P)		Compensated or Hicksian demand X (U, p).
This is obtained by maximizing direct utility subject to a budget constraint	=	This is obtained by minimizing expenditure subject to a utility constraint
Direct utility function U(x)	=	Indirect utility function V(M,p)
		Using Roy's identity the Marshallian demand can be obtained

(Deaton and Muellbauer 1980)

2.2.2. Relevant Extensions of Demand Analysis

Through the above discussion, the traditional theory of consumer behaviour is discussed. This traditional approach has however been expanded since its introduction; for instance, the relationship between the commodities that an individual or household consumes and their budget constraints has been expanded to consider a partial equilibrium context. Strotz (1957) introduced the concept of the utility tree. Below is an example of possible utility tree extracted from Deaton and Muellbauer (1980).

Figure 7. Utility Tree



Strotz (1957) argued that the utility trees allow commodities to be grouped in branches with weakly separable utilities. Thus the utility tree presented above depicts both separability and multi-stage budgeting. The implication of multi-budgeting process is that the marginal utility of consuming commodities from one branch is independent of the marginal utility of consuming commodities from other branches; Moschini and Moro (1993) state that this assumption allows researchers to analyze a category of related goods in isolation from other groups. Deaton and Muellbauer (1980, pp.122-142) argue that behaviourally, this concept allows for two-stage or sequential budgeting where the first stage allocations are made to the branches and in the second stage, allocations are made with in a particular branch. This ideally is what researchers do when they model demand for particular commodities. The researchers tend to consider only commodities with in a particular branch of the utility tree. It is worth noting that there are different

types of separability other than the "weak" separability. However, separability in whatever form is a necessary and sufficient condition for two stage budgeting (Deaton & Muellbauer, 1980).

Household production theory is another relevant extension of consumer demand theory. The champions of this theory are Gorman (1956), Becker (1965), Muth (1966), and Lancaster (1966). Becker (1965) expanded the concept of utility maximization to include human activity. He added to the traditional consumer theory by incorporating a time constraint, safety or comfort on the purchase of goods and services.

Muth (1966) argued that households purchased commodities as inputs to be used in their production process with the non-market goods as the outputs. Lancaster (1966) expanded on this concept by arguing that consumers/households purchased goods and services with their attributes/characteristics as inputs into the household production. Therefore, Lancaster established the idea that there is a relationship between commodities and their attributes/characteristics.

Thus, over the years, there has been a growing interest in attempting to understand how individuals or consumers make their choices when they select a good or service. Using demand models and systems is just one way of attempting to understand consumer choice. Discrete choice analysis is another application that attempts to answer the problem of consumer choice. It is worth noting that despite the fact that all these methods may be different they all still employ the fundamental assumptions of consumer economics embedded in the idea of utility maximization.

2.3. Time Series Versus Cross-Sectional Versus Longitudinal/Panel Data Analysis

Time series analyses allow us to observe the values of a variable over time. Consequently, the two main goals of time series analysis are (1) to identify the pattern represented by the observations and (2) forecasting. Both goals require that patterns of the observed time series are identified. Time series data has been widely used because the data are readily available in aggregate form and modelling with this data is analytically simpler, more convenient and more affordable (Chung and Kaiser 2002). Most time series models assume that there is a representative agent from which general conclusions can be drawn. However, time series data may provide misleading conclusions since the approach down plays the importance of heterogeneity in individual behaviour (Chung and Kaiser 2002). However, with increased possibility of obtaining cross-sectional data[6] from public agencies and private businesses such as ACNielsen the use of cross-sectional data is becoming more common. Manchester (1977) argued that demand analyses based on time series data are unsatisfactory because aggregation usually hides the many changes in the groups that compromise the whole. Thus, cross sectional studies allow the researcher to take into account impacts of the demand functions that are related to the socio economic and demographic characteristics of the population sample that is being studied.

Longitudinal/panel data contains observations on very many individual or families each observed at several points in time. Panel data sets, are normally very large cross sections, consisting of thousands of micro units which are followed through time, but the number of periods is often quite small (Greene 2003). Greene notes that time

[6] Cross sectional data has information on similarities or differences across individual at a moment in time.

series effects are often viewed as "transitions" or discrete changes in time. They are typically modelled as specific to the periods in which they occur and are not carried across periods within a cross sectional unit. Greene suggests that panel data sets are more oriented towards cross-sectional analysis because they are wide and typically short. Finally, he further notes that heterogeneity across units is an integral part and indeed often the main focus of the analysis.

Thus, panel data/longitudinal data may be preferred over time series or cross-sectional data because it provides such a rich environment for the development of estimation techniques and theoretical results (Greene, 2003). In particular, panel data allows the researcher great flexibility in modelling differences across individuals compared to cross-sectional data. Panel data or longitudinal data has been widely used in the field of marketing economics. Examples for such studies include a study by Keane (1997b) which used panel or scanner panel data to model heterogeneity and state dependence in consumer choice behaviour for ketchup purchases. Keane found that one of the difficult tasks involved in using scanner panel data is the construction of the vector of prices faced by each consumer on each purchase occasion. Thus, the basic problem is that one only observes the price paid by the consumer for the brand or product actually purchased; prices for other brands or products or substitutes must be inferred.

Similarly a study by Chintagunta, Kyriazidou and Perktold (2001) used panel data to analyze household brand choices. In that study, the researchers used the AC Nielsen panel data on yogurt purchases for the analysis. In that study however, the data collection agency also collected data on other brands and other market factors such as promotional tools (coupons, advertised prices in local newspapers and so on). Thus, for this study it

was almost possible for the researchers to recreate the store environment for each purchase occasion made by a household member.

Another study by Erdem, Imai and Keane (2003) used panel data to develop a model of household demand for frequently purchased consumer goods that are branded, storable and subject to stochastic price fluctuations. Similar to the above studies, ACNielsen panel data on ketchup purchases was used for the analysis. Furthermore, the study by Honore and Kyriazidou (2000) considers identification and estimation in panel data discrete choice models when the explanatory variable set includes exogenous variables, lags of the exogenous dependent variable as well as unobserved individual specific effects. The study showed that it is possible to identify panel discrete choice models within the logit framework.

Another study by Smed and Jensen (2002) used weekly household panel data for milk purchases in Denmark to quantify major determinants of the demand for fluid milk, including the relative importance of taste and healthiness, measured by the relative willingness to pay for such attributes. Unlike the previous studies mentioned which used Random utility models, that particular study used the Almost Ideal Demand System for its analysis.

There is no question about the importance of generating more robust estimates. The use of longitudinal/panel data provides the opportunity for such estimates to be generated.

Table 7. Summary of the Strengths and Weaknesses of Three Types of Data

Type of data	Strengths	Weaknesses
Time series	• Readily available • Modeling is analytically simpler • More convenient • Affordable	• Downplays the importance of heterogeneity in individual behaviour
Cross section	• Accounts for heterogeneity • Accounts for micro-level behaviour	• Static i.e. does not consider time
Panel	• Accounts for temporal tendencies such as state dependence in micro-level behaviour • Rich environment for the development of estimation techniques and theoretical results • Using panel data the effects of omitted variables can be explicitly accounted for when modeling. Because there are many limitations to modeling human behaviour, there is considerable heterogeneity in the response variable, even among people with the same characteristics.	• Expensive

Sources: (Chung and Kaiser 2002; Dale and Davies 1994; Greene 2003; Heckman 1979)

2.4. The Economic Concept of Value

Freeman (2003) states that the term "value" has several meanings; for instance he notes that economists and ecologists use it differently. Ecologists mainly use the term to mean "that which is desirable or worthy of esteem for its own sake; thing or quality having intrinsic worth" (Webster's New World Dictionary, 1988). Economists however define value as define it as "a fair or proper equivalent in money, commodities ..." (Webster's New World Dictionary, 1998). Freeman (2003) states that in this case "equivalent in money or commodity" represents the amount of money or commodity/commodities that would have an equal effect on a person's welfare or utility.

This difference in definition is where the idea of intrinsic and extrinsic value of a good or commodity finds its origins. Something is said to have intrinsic value "if it is valuable 'in' and 'for' itself-if. Its value is not derived from its utility, but is independent of any intrinsically valuable entity and is said to be an 'end-in-itself' not just a 'means' to

another's end" (Callicott 1989), 131). On the other hand, something is said to have extrinsic value if it is valued as a means to some other end or purpose (Freeman 2003). Some possible intrinsic and extrinsic attributes for shell egg products are shown below:

Table 8. Intrinsic and Extrinsic Attributes Associated With Egg Products

Intrinsic Attributes	Extrinsic Attributes
1. Food Safety Attributes	1. Test/Measurement Indicators
• Food borne pathogens	• Certification
• Physical hazards	• Labelling
2. Nutrition	• Minimum quality standards
• Calories/fat/cholesterol	2. Cues
• Proteins	• Price
• Vitamins and minerals	• Manufacturer origin
• Omega3	• Store name
3. Sensory Attributes	• Packaging
• Taste	• Advertising
• Appearance	• Past experience
• Freshness	• Other information provided
• Smell/aroma	
4. Value/ Function Attributes	
• Composition	
• Convenience	
• Package materials	
• Shelf life	
5. Process Attributes	
• Animal welfare	
• Traceability	
• Environmental impact	

Source: (Caswell et al, 2002, p.57)

Freeman (2003) defines economics as the study of how society organizes itself to provide for sustenance and well being of its members. Subsequently, the economic goal is to develop policies and products that increase human well being or welfare. Thus the rationale for the economic theory of value is based on the ability of things to satisfy people's needs and wants. Hence, the economic value of a good or thing or policy is a measure or indicator of its contribution to people's well-being/welfare/utility. The assumption behind the economic value of a commodity is that each individual is the best judge of how well off he or she is given a situation. Freeman (2003) also notes that people can value the survival of other species not only because of the uses people make of them, but also because of an altruistic or ethical concern (e.g. concern for animal welfare for livestock). Thus, there is an underlying notion that people trade off among commodities when they make decisions about issues that affect their well-being or utility. Hence, the trade-offs that people make when they choose less of one good and substitute more of some other good tell us something about the values people place on these goods.

The value that people place on various items can be expressed either in terms of willingness to pay or willingness to accept compensation. Willingness to pay in money terms is defined as the maximum amount of money that a person would be willing to pay rather than do without an increase in some good (Freeman, 2003). Willingness to accept compensation is the minimum amount of money that a person would require to voluntarily forgo improvement while receiving the extra money. The underlying notion behind both value measures is the idea of trade-offs or substitutability however, both methods adopt different points for levels of well-being (Freeman, 2003).

2.4.1. Methods of Measuring Value

The major difference between methods that have been used to value goods with environmental, animal welfare, nutrition and food safety attributes is based on the source of the data (Mitchell and Carson 1989). The origin of the data can be from observations of people's behaviour in the real world such as a market place or the data can come from people's responses to hypothetical questions (Freeman, 2003). The method that uses real data from the market place is often referred to as the revealed preference method while the method that uses information from hypothetical questions is often referred to as the stated choice method.

2.4.2. Stated Versus Revealed Preference Methods

A number of valuation techniques have been developed that try to elicit people's preferences for various goods and services. The preference based outcome measures are generally divided into two approaches: the stated preference method and the revealed preference method. The adoption or use of the respective methods depends on the good or service in question. The stated preference method relies on respondents making choices over hypothetical scenarios. Respondents are asked to choose the 'best' alternative among a set of hypothetical scenarios, which are completely described by a set of attributes generated from an experimental design. The revealed preference method is a market based analysis and consequently refers to the observation of preferences revealed by observing real market behaviour. A requirement for applying the revealed preference method is that there is a market demand curve for the good or service in question. The revealed preference is normally constrained in that it refers to analysis of individuals' preferences for a closely related good or service that is already available in the market.

Thus, the price of a good or service in the market can be used as an indicator of the non-market good. For instance, in an analysis of preferences regarding more friendly animal husbandry practices, it might be useful to perform market analysis of free run/range eggs, where the value for the free range/run egg is used to represent the value of adopting more animal friendly husbandry practices.

In comparison to the stated preference methods the revealed preference methods capture 'use value'7 and not the total economic value of a good or service. Also, the measurement of welfare differs between the stated and revealed preference methods. The revealed preference method relies on the market demand curve while the stated preference method relies on the income-compensated or Hicksian demand curve. The welfare measure captured in revealed preference methods is the consumer surplus8, while the stated preference measures capture true welfare measures which are the compensating variation9 and the equivalent variation10.

Some of the problems associated with the revealed preference methods are that the attributes of goods or services tend to be collinear in the market data. This makes it difficult to predict the effect of independent variations of respective attributes. In such an instance, the stated preference data pose an advantage over the revealed preference data or market data. It should be noted that there are also potential problems associated with using stated preference data. The immediate problem associated with the stated preference data is that respondents have no incentive to make choices in the stated

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[7] Use value' is defined as the value derived from the actual use of a good or service.
[8] The area below the demand curve and above the market price.
[9] "The maximum amount that an individual would be willing to pay for the opportunity to consume at the new price set" (Freeman, 2003, p.51).

[10] "The maximum amount that an individual would be willing to pay to avoid the change in price" (Freeman, 2003, p.51

preference experiment in the same way as they would in the market. And even though people respondent genuinely in the stated preference experiment it still falls short from a real market situation in that some market aspects such as search costs are absent.

The stated preference experiments are defined by the attributes presented while in market data there may be attributes observed and perceived by the consumer but unobserved by the researcher. These are normally captured in the estimation process via the error term (Keane 1997a). The revealed preference methods include the hedonic pricing approach and the travel cost method while the stated preference method includes the contingent valuation method and the experiment auction method.

2.5. Product Differentiation

Product differentiation is a way in which firms distinguish their products through branding, pricing and/or adding value. For instance, if two or more firms offered the same product but gave it a different name due to the uniqueness of the production methods used or other features, these products would be viewed as heterogeneous in nature. The differentiation of goods along key features and minor details is an important strategy for firms to defend their price. Also, through product differentiation, firms can develop a niche for their products. Other than competitive purposes, a differentiated market may occur due evolving consumer/household preferences (Piana 2003).

However, a task develops in determining what products to develop and whether the new products will perform well in the already existing market; researchers and consequently food producers and processors are interested in knowing whether consumers are willing to pay for the development of specialized and value added products since the provision of these products implies increased costs for the producers

and processors. From the above discussion, the Canadian egg industry can be viewed as differentiated one separated by either the intrinsic or extrinsic values that each individual egg product possesses.

2.6. Summary of Canadian egg studies

Canadian egg consumers have changed their egg consumption patterns during the last 3 decades. Understanding these changes is of vital importance to egg producers, processors and government policy makers. Also, in a supply management system where producers decide how much to produce for a given price, understanding the relevant demand elasticity is very important. In order to understand the impact of new policies on any market or economy it is important to know what factors will affect consumer demand for that particular product or products. If a policy change results in a higher price for the commodity then the quantity demanded by consumers will tend to decrease. In fact if the demand for such a commodity is price elastic, then consumer expenditure on that commodity will fall, hence reducing the income to processors and producers and vice versa. It is difficult to identify and quantify the causes of changes in shell egg demand, particularly since many of the factors affecting consumer purchasing behaviour have changed concurrently over the past few years. Also, in the past few decades factors that that affect demand have been changing. These factors include social and economic demographics, health concerns, nutritional concerns, environmental concerns, animal welfare concerns, advertising, media coverage and research and development.

Hassan and Johnson (1976) estimated a system of demand equations for 27 food commodity groups and a non-food group for Canada for the period 1950-1972. The objectives of this study were to provide a review of (a) modern demand theory (b)

estimates of demand elasticities for major food products (c) to present a full system of demand parameters for food (d) to provide an assessment of the policy implications of the full demand system and to indicate possible methods of using such estimates in forecasting and decision making. The data used for this study included retail prices, per capita consumption and per capita disposable income for the all the 27 food categories. Both time series data obtained from a handbook of Food Expenditures, Prices and Consumption provided by Statistics Canada and cross sectional data taken from the 1969 Family Food Expenditure survey prepared by Statistics Canada were used in the analysis. For the analysis Hassan and Johnson chose to use the double logarithmic demand function to estimate systems of demand equations for the different foods. For the purpose of this thesis we will only be concerned with the estimates obtained for eggs. The results obtained from Hassan and Johnson's analysis for eggs found eggs to have a price elasticity of -0.12 and an income elasticity[11] of 0. This result suggests that eggs are inelastic with respect to price changes. The 0 income elasticity for egg products suggests that there is a weak link between fluctuations in income and the spending decision on eggs.

Kulshreshtha and Ng (1977) state that " a knowledge of interrelationships that exist among various market forces operating within a particular commodity sector, such as demand, supply, prices and trade is useful for both public as well as private decision making" (p.1). For this reason, Kulshreshtha and Ng chose to analyze the Canadian egg

[11] Income elasticity of demand measures the relation ship between a change in quantity demanded and a change in income. Normal good have positive income elasticities of demand. Necessities have income elasticities of demand of between 0 and 1. Luxuries have income elasticities of demand greater than 1 (Demand rises more than the proportionate to change in income). Inferior goods have negative income elasticities of demand. And lastly, an income elasticity of demand close or equal to zero implies that there is a weak link at best between fluctuations in income and spending decisions.

industry since at the time the industry was witnessing a decline in per capita egg consumption and supply management had been introduced in the egg industry. The primary objective of this study was to develop an econometric analysis of the quarterly fluctuations of in the Canadian egg industry, particularly those in price, demand, supply, and trade. The specific objectives of the study were (1) to develop a conceptual model of the functioning of the Canadian egg economy and to determine the major variables affecting various relationships; (2) to estimate the model using contemporary econometric techniques; (3) to estimate short-run demand and supply elasticities; and (4) to test the predictive performance of the model in forecasting egg prices for the year 1974. The analysis was based on Canadian quarterly data for the period 1961-1973.

Kulshreshtha and Ng (1977) estimated egg demand model parameters by applying the Three-Stage Least-Squares procedure to pooled quarterly data. The model specified for the Canadian egg market contained a total of 12 relationships relating various types of demand for eggs, supply and prices at various levels of marketing system. The results from the study found the price elasticity of eggs to be -0.003 and income elasticity -0.0267. This study finds eggs to be less price elastic compared to the study by Hassan and Johnson (1976) and the negative income elasticity suggests that eggs are an inferior good.

Johnson and Safyurtlu (1984) provide an updated set of final demand parameters for the major food groups in Canada. Data for the period 1960 to 1981 is used in estimating the demand parameters. In this study, four models were estimated. In the first three models time series data are used while in the fourth model both time series and cross-section data was used for the analysis. The times series data are obtained from the Agriculture Canada handbook (1983) while cross-sectional data are obtained from a

survey of family food expenditures from 1974, 1976 and 1978. This study found the own price elasticity of eggs to be -0.12 and income elasticity to be 0. This result is similar to that produced by Hassan and Johnson (1976).

Another study that provides price and income elasticities for eggs is by Andrikopoulos and Carvalho (1984). Andrikopoulos and Carvalho's (1984) first objective was to discuss and test empirically a new functional form for estimating complete systems of expenditure equations and secondly, Andrikopoulos and Carvalho (1984) estimated and critically evaluated the expenditure and price elasticities of protein commodities for Canada. A Dynamic Generalized Linear Expenditure system (DGLES) was used to carry out the analysis. The DGLES was estimated for Canada using yearly data from 1958 through 1981 for consumption expenditures on beef, dairy products, fish, eggs, poultry, and pork. This study found the own price elasticity of eggs to be -0.545 and income elasticity to be 0.417. In this study egg demand is quite price elastic as compared to the studies discussed earlier and the positive income elasticity suggest that eggs are a normal good. This difference in the results from previous studies may be due to the difference in functional forms used for the analysis and the time span dealt with.

Curtin, Theoret and Zafiriou (1987) derived elasticities for meats, beverages, fruits, vegetables, fats and oils, cheese, ice cream and eggs. Both time series and cross-sectional data from 1960-1985 are used in the study. The time series data on demand were obtained from Statistics Canada's Apparent Per-Capita Food Consumption data (Statistics Canada, Catalogue No. 32-229 and 32-230, Annual). Quarterly consumption data were retrieved from FARMBANK (Agriculture Canada). The price indexes for products were obtained from Statistics Canada Catalogue No. 62-010, Prices and Price

indexes and the income data from National Income and Expenditure Accounts (Statistics Canada, Catalogue No. 13-201). Most of the above annual data is made available in an Agriculture Canada Handbook (Robbins, 1986). The cross sectional data was obtained from survey data from the 1982 Family Food Expenditure Survey as presented by Theoret (1986).

The own-price elasticities were calculated using time series data while the income elasticities were derived from cross-sectional data. A log-log demand functional form and the ordinary least squares technique was used to estimate the demand parameters. Because of the correlation between income from time series and the time trend, Curtin, Theoret and Zaferiou (1987) imposed income elasticities based on survey data in the equation. The study found that the price elasticity of eggs to be -0.07 with an imposed income elasticity of -0.058. These results indicate that eggs inelastic with respect to price changes.

To continue in the tradition of consumer food demand analysis at Agriculture Canada, Barewal and Goddard (1985) applied contemporary consumer demand analysis to the expanding data base on Canadian consumer food demand. The rational of the study was that it was/is important to consider what Canadian consumers want to buy at present and how these products can be expected to change in the future. Barewal and Goddard (1985) also noted that it was not only important to consider what effects changes in economic factors such as income and price may have on the pattern of food demand but also changes in taste should be considered as well. They also ask how changing demographic factors such as age affect how much and what types of food products consumers will choose to buy in the future. Thus, the purpose of the study was

to provide updated and statistically accurate estimates of the responses of consumers to changing market conditions.

The estimates were derived utilizing demand theoretic restrictions via a joint estimation procedure. The data used was categorized into two categorizes, the first being time series data of aggregate consumption and the second was cross-sectional data on household level consumption. The Almost Ideal Demand System (AIDS) was chosen for this study. The estimation was carried out in two phases. In the first phase, full budget share was used to estimate Engle functions for food and non-food demand systems and food at home and food away from home demand systems. To investigate the effect of socio-economic and demographic characteristics on the estimated Engle functions and food demand systems, the data was divided by income strata, family type, and employment status, education attainment of the head of the household and by tenure of the family home. In the second stage, the family food expenditure survey data for seven food disaggregates was used to estimate Engle curves, single demand equations, with and without demographic variables and systems of demand equations with and with out demographic and socio-economic scales. The study found that the price elasticity of eggs was -0.287 with an income elasticity of 0.154 when demographics and socio-economic variables were omitted and the price elasticity of eggs was -0.126 with an income elasticity of 0.146 when demographics and socio-economic variables were included. The above results show eggs to have a minimal sensitivity to price increase and the income elasticities, although low, show eggs to be normal goods.

Due to the declining demand in egg consumption in the 1980s and 1990s the egg industry decided to focus some of its efforts on advertising and research and development

as way of reversing the trend towards shell eggs. There are a number of studies that dealt with these issues of shell egg advertising and research and development.

The first study to be considered is by McCutcheon and Goddard (1991). The goal of the study was to determine the social welfare implications of generic advertising since at the time the CEMA had started to engage in active advertising campaigns to address the problem of declining shell egg demand. An econometric model of the Canadian egg market was developed and used to simulate welfare effects of egg advertising on producers, consumers and society as a whole. The results from this study showed that advertising was an effective way of increasing the demand for eggs thus providing both consumers and producers with additional welfare. Also, demand elasticities for eggs using an expenditure-dependent demand equation and retail price-dependent demand equation for periods 1978-1989 and 1978-1997 were generated. Table 8 shows the results from each of the respective equations and considered time periods. The results obtained from this study show eggs to be price elastic with the results from the retail price equation being more price elastic than the expenditure equation. Both studies however show eggs to be very sensitive to price increases as compared to previous studies. These high price elasticities may be due to the estimation techniques that were chosen or they may be a reflection of the tainted reputation that eggs had got over the years as an unhealthy food source. The income elasticities from both equations suggest that eggs are inferior goods. This conclusion is similar to that reached by Curtin, Theoret and Zafiriou (1987).

Chyc and Goddard (1992) developed and applied optimal investment rules for CEMA that chooses to engage in both advertising and Research and Development (R &

D). The reason why advertising is such an important aspect of any firm, including those in the Canadian egg industry, is because advertising aims to shift the demand curve out for the firm product and/or decrease its demand elasticity (Koutsoyiannis 1982). CEMA for instance through 1990s until today spent millions of dollars in advertising. This advertising was done through television, the internet and by creating a visual identity (Canadian Egg Marketing Agency 2001). Examples of CEMA advertisements include the tag line *So simple. So good* (CEMA, 2001). Another reason a firm would get involved in R & D is to develop new technologies which lower costs and of the production process. Also, R & D can be used to develop new products. However, Chyc and Goddard concentrated on R & D that reduces the costs of production. In order to achieve their objective, the authors quantified the link between advertising and sales and the link between R & D and marginal costs in the egg industry.

The data used for the study was obtained from the Agriculture Canada Farm databank and Statistics Canada for the period 1974-1989. The information that was collected was on disappearance, production, breaker demand, net trade in eggs and prices of eggs. Three demand equations were estimated and each provided price and income elasticities. These elasticities are shown Table 8. The results from all the three equations show eggs to be price elastic and the income elasticity shows eggs to be a normal good.

Similarly, the study by Goddard (1995) attempted to develop and apply optimal investment rules for CEMA that chooses to engage in both advertising and R & D. The difference between Goddard's (1995) and Chyc and Goddard's (1992) study was that the former considered the advertising and R & D issues in the context of a partial liberalized market. The latter, however, considered both issues in a regulated market. Trade

liberalization is an important issue since Canada is a member of both the WTO an NAFTA. As shown in the earlier chapters being a member of these organizations requires Canada to open up its market to products from member countries. With regards to advertising and R & D, Goddard (1995) reached similar conclusion as the previous studies. Results from both studies also recommended that CEMA get involved investing in basic research to increase marketing opportunities (Chyc and Goddard, 1992) and forestall the market realities associated with increased trade (Goddard, 1995). Also, both studies highlighted the importance of examining the returns to a variety of activities that the industry may be engaged in.

Another study by Hailu and Goddard (2004), tests whether there is a structural change in the egg demand of Canadian consumers due to egg cholesterol information. This study econometrically scrutinized the impact of the introduction of functional eggs into the market. Furthermore, this study investigated the interactive effects of different media influences on consumer choice decisions. Both a parametric and non-parametric revealed preference method was used for the analysis. The data used in the estimation process consisted of quarterly time series data from 1978 to 2001 on retail price, per capita consumption, real per capita generic advertising, and egg-cholesterol information for shell egg and breaker eggs. Egg disappearance data, price and price index data, population, income were obtained from Statistics Canada CANSIM database. Medic indices were created through access to FACTIVA database (Dow Jones/Reuters), advertising expenditure data on eggs and related products were sourced from AC Nielsen. The media information index was constructed as the difference between the number of positive and negative new articles and is used as a proxy for consumers' awareness of

egg-cholesterol link (negative) and introduction into the market of new functional egg products (positive).The AIDS model adopting a two stage budgeting procedure was used in the parametric method. Consumer demographics were not included in the model estimation.

The results from the parametric model revealed that the impacts of advertising and media information index were significant and changed with time. The study also found that more frequently egg friendly articles appeared, the bigger the impact of shell egg advertising. The study also found that there was a relationship between direct shell egg disappearance and indirect breaker egg disappearance (i.e. consumers were found to be substituting egg products and prepared foods purchases for shell eggs). Further still, Hailu and Goddard (2004) generated price and income/expenditure elasticities for both conditional[12] and unconditional Marshallian egg demand. The respective elasticities are reported in Table 9. The results from the conditional and unconditional demand systems show eggs to be price inelastic and the estimates are more similar to those from earlier studies. The income elasticity from the conditional demand systems shows eggs to be normal goods compared to the unconditional demand systems that show eggs to be inferior goods.

[12] Conditional demand functions express the demand for a good as a function of its own price, the prices of some (but not all) other goods, total expenditure on these goods and the quantities remaining of the remaining goods (Pollack, 1969).

Table 9. Summary Price and Income Elasticities

Authors	Price Elasticity	Income Elasticity	Period
Hassan and Johnson	-0.120	0.000	1950-1972
Kulshreshtha and Ng	-0.003	-0.267	1961-1973
Johnson and Safyurtlu	-0.120	0.000	1960-1981
Andrikopoulos and Carvalho	-0.545	0.417	1968-1981
Barewal and Goddard. (excluding demographics)	-0.287	0.154	1972, 1974, 1976, 1978
Barewal and Goddard. (including demographics)	-0.126	0.146	1972, 1974, 1976, 1978
Curtin et al.	-0.070	-0.058	1960-1985
McCutcheon and Goddard			
(1)Expenditure equation			
(a)	-1.120	-0.860	1978-1989
(b)	-2.160	-0.900	1978-1987
(2) Retail price equation			
(a)	-7.270	-1.120	1978-1989
(b)	-4.710	-0.852	1978-1987
Chyc and Goddard			
Equation 1:	-0.856	0.439	1974-1989
Equation 2:	-0.849	0.293	1974-1989
Equation 3:	-0.895	0.723	1974-1989
Hailu and Goddard			
Conditional elasticity	-0.704	0.768	1978-2001
Unconditional elasticity	-0.189	-0.079	1978-2001

2.6.1. Summary

Results of earlier studies (Curtin et al. 1987; Hassan and Johnson 1976; Kulshreshtha and Ng 1977; Johnson and Safyurtlu 1984; Andrikoploulos and Carvalho 1984) show the price elasticity of eggs to be low as compared to later studies by McCutcheon and Goddard (1992), Chyc and Goddard (1992), Hailu and Goddard (2004), thus, today egg demand appears to be more price elastic. The income elasticities from the egg studies have mixed results. Some studies show eggs to be inferior goods (negative income elasticity implies that the more income people earn the few eggs they purchase) while other studies show eggs to be normal goods. Thus, a particular pattern on whether the income elasticity of eggs has been changing with time cannot be established.

Curtin, Theoret, and Zaferiou (1987) conclude that extreme care should be given when interpreting elasticities because they change with time and are also very sensitive to the methodology used. Curtin et al also conclude that to understand elasticities one must understand the data that was used in the estimation. These reasons could be used to explain the different elasticities presented by the studies above. Because products are constantly changing (for instance today there more variety of egg products than there used to be 20 years ago), determining what factors are influencing egg demand is of great importance to the egg industry.

The difference between this study and those mentioned above is that all the above studies treated eggs as a homogeneous product. No study has generated elasticities for the different egg products in the market today. Thus, this study is different from all the above studies in that eggs are treated as differentiated products each with a unique attribute.

2.7. Relevant Studies: Egg and Non-Egg Studies

There are a plethora of studies that have looked at firm or organizational attempts to exploit consumer concerns on animal welfare, food safety, health and nutritional and environmental stewardship. These studies have examined health and nutritional marketing claims (Dixon and Shackley, 2003; Urala, Arvola and Lahteenmaki, 2003); environmental marketing claims (Loureiro et al., 2002; Harper and Makatouni, 2002; Cason and Gangadharan, 2002; Galarraga and Markandya, 2000); and marketing claims on animal welfare (Egbert et al. 2003; Harper and Makatouni, 2002; Bennett, Anderson, and Blaney, 2002; Phan-Huy, and Fawaz 2003) and food safety (Baltzer, 2004, McEachern and Warnaby 2004; Maruyama and Kikuchi, 2004; Gerhardy and Ness, 1994) as they occur on products, packaging, or advertising.

Studies like the ones mentioned above have resulted in a more transparent picture of what actually constitutes nutrition, animal welfare, food safety and environmental claims and may have contributed to enhancing our understanding on how marketers have and should proceed in order to capitalize on the above consumer concerns. These studies have revealed that claims may have different impacts based on how consumers interpret them and this may in turn lead consumers being confused and overwhelmed by the many products. This claim is supported by Baltzer's study (2004) that found that the more varieties there were in the egg market, the harder it become for consumers to distinguish the quality attributes between the various varieties. Ruben (2003) found that with many products containing credence[13] attributes, a difficulty arose in the consumers' ability to detect the quality attributes in pre and post purchase evaluations. And to support this

[13] Credence good are goods that consumer cannot judge the actual quality before and after purchase (Benner, 2004)

claim, a study by Harper and Makatouni (2002) found that consumers were confused over product attributes and quality claims such as organic and free-range. McEachern and Warnaby (2004) also noted that the quality of meat is an important factor to consumers; in addition to this, McEachern and Warnaby note that this is an area that is characterized by consumer confusion since there are over 40 quality assurance labels operating in the UK in the meat, salmon, milk, cereals, eggs, fruit and vegetables industry.

Another branch of research has focused on trying to understand the sources of consumer confusion. For instance the study by Cason and Gangadharan (2002) found that consumers lacked the knowledge or information pertaining to product quality. While the study Urala and Lahteenmaki (2003) found that consumers lacked knowledge with regard to the perceived health claims and benefits associated with functional foods[14]. Urala and Lahteenmaki (2003) state that this confusion among consumers may be explained by the fact that the consumer's ability to evaluate and interpret the health related claims and perceived benefits have not kept pace with the product differentiation and product development. Urala and Lahteenmaki suggest that one way of bridging the gap between the consumers and the industry-led developments could be by the industry engaging the consumers within the market chain. This could be done by, for instance, providing effective avenues such as advertising (McCutcheon and Goddard, 1991) and labelling to help consumers in evaluating the various products (Korthals, 2001). Sunding (2003) suggest that the egg industry supports initiatives that quantitatively and qualitatively

[14] Functional foods are foods that are consumed for specific health benefits/purposes. These foods may contain one or more nutrients or non-nutrient substances that may offer some health benefits (Shallo, 2004). Eggs are examples of functional foods because they contain 13 important nutrients and minerals (Shallo, 2004)

assess the influence that consumers' perceptions, beliefs, and attitudes have on product evaluation and purchasing decisions.

The previous studies have also shown that consumers are willing to pay premiums for products that are geared towards their specific preferences (Dixon and Shackley, 2003; Loureiro et al., 2002; Baltzer, 2004; Andersen, 2003; Guagnano, 2001; Huang, Kan and Fu, 1999). From these studies one can deduce that premiums are not homogeneous amongst different demographic groups. A wide variety of consumers socio-economic characteristics have been used to analyze the difference in consumer's willingness to pay. Demographics that have been considered in previous studies include age of the head of the household, presence of children, income, gender, household size, education level. Studies such as those by Huang, Kan and Fu (1999); Batte, Beaverson, Hooker and Haab (2004); Loureiro, McCluskey and Mittelhammer (1999); Veeman and Adamowicz (2000) found consumers demographics to influence their choices and preferences for the respective products while studies such as those by Brown, Cranfield and Henson (2005); Hobbs (2004); Cranfield and Magnusson (2003) found that socio-demographic factors played a relatively unimportant role in the selection of the respective products.

Most of these studies have however used the stated preference method. Very few studies (e.g. Baltzer, 2004; Andersen, 2003; Galarraga and Markandya, 2000) have used the revealed preference method to analyze people's willingness to pay for the various characteristics of the good. The general finding among the revealed preference studies is that there seems to be missing a consumer opinion, specifically what constitutes sound environmental, animal welfare or food safety policies/ information. Most of the stated preference studies and the egg industry innovations have relied on their own

interpretations of what constitutes an animal welfare friendly commodity or an environmentally friendly commodity. Yet, it is the consumers view on what is a socially friendly or value added good that would be of paramount importance since they (consumers) are the ones that make the consumption decision based on the information that is relevant, significant and specific to them. In this thesis we argue that there exists a gap between what the consumers' on the one side and the industry on the other side consider to be socially friendly. The degree of symmetry between the consumers and/or the egg industry in the literature of value added or specialty foods has yet to be determined. Information obtained on how consumers are behaving towards the already existing value added and specialty egg products in the market would aid the egg industry and researchers claims and could consequently provide additional information and legitimacy to prior findings.

Also, most of the studies that have looked at issues concerning animal welfare, food safety, environmental, and health/nutritional concerns with regards to shell eggs have been conducted outside of Canada. A lot of the literature with regards to eggs is from Europe and the US. This revelation should not however underscore the level of food safety, animal welfare, environmental and health/nutritional concerns in Canada. There are some studies such as those by Cranfield and Magnusson, 2003 that tried to determine whether Canadian consumers would be willing to pay a premium for Pesticide Free Production (PFP) and Magnusson and Cranfield, 2005 which analyzed consumer response to the introduction of food products containing PFP inputs, Brown, Cranfield and Henson (2005) examined food safety issues, Veeman and Adamowicz (2000) investigated food safety and nutritional/health issues with regards to milk while Hobbs

(2004) examined the economic incentive of implementing traceability systems; specifically Hobbs' study dealt with issues of animal welfare, food safety and farm of origin using other food products other than shell eggs. A summary of the studies mentioned above and other studies that have dealt issues with regard to animal welfare, food safety, environmental and health/nutritional concerns are provided in Table 10 and Table 11.

Table 10. Summary of Previous Studies

Author	Objective	Source of data and method	Results and Conclusion
Dixon and Shackley (2003) *Product: Flour* *Place: UK*	Access the public attitude towards the fortification of flour with folic acid and the intensity of preference towards the proposed policy.	• 76 people were interviewed in UK households. • Contingent valuation method. (stated preference method)	• Younger and poorer people tended to favour fortification compared to those opposed to it. • Reasons for being willing to pay were centred on the health benefits, with particular reference being made to the intervention saving lives and it being preventative. • Those opposed tended to believe that there was insufficient evidence.
Loureiro, McCluskey, and Mittelhammer (2002) *Product: Apples* *Place: Portland*	Assess peoples mean willingness to pay for eco-labelled apples certified by The Food Alliance a non-profit third party certifying organization based in Portland, Oregon.	• Survey data. • Double-bounded logit. (stated preference method)	• Female respondents with children and strong environmental and food safety concerns were more likely to pay a premium for eco-labelled apples. • The premium that was small. • This fact reflects the difficulty with garnering a premium based on "environmentally" sound practices.
Egbert, Groen, and De Greef (2003)	Indicate the aspects of modern pork production systems that may give rise to	Literature review	• The communication about those aspects towards consumers and citizens can be

Author	Objective	Source of data and method	Results and Conclusion
Product: Pork *Place: Europe*	concerns with various groups of actors and that thereby might affect the acceptability of pork production by these groups.		adjusted or even extended to give them better possibilities to make food choices or to develop their own opinions about pork production. • Producers could change the pork production system such that it better satisfies consumers and citizens.
Baltzer (2004) *Product: eggs* *Place: Denmark*	Introduce an approach to estimate the marginal willingness to pay for food quality and safety.	Actual data on five different varieties of eggs from Danish supermarkets was used. AIDS-specification (revealed preference method)	• Consumers were willing to pay a relatively high premium for improved animal welfare and organic production methods and somewhat less for food safety.
Harper and Makatouni (2002) *Place: UK*	Investigate consumer's attitudes towards organic food in the UK with emphasis (1) organic food (2) animal welfare.	Focus group discussions. (stated preference method)	• Consumers confuse organic and free-range food products as equivalent. • Animal welfare is used as an indicator of other, more important product attributes such as food safety and the impact of health. • Concerns towards animal welfare increased consumer purchase for organic food. • Organic market could take advantage of research on consumer motivation to buy

Author	Objective	Source of data and method	Results and Conclusion
			free range products by embodying ethical concerns as an indicator of product quality.
McEachern and Warnaby (2004) *Product: Fresh Meat* *Place: UK*	Identify the meat purchasing behaviour of consumers and their perceptions, attitudes and knowledge towards the main quality assurance labels in the UK.	Postal questionnaire targeted towards consumers of fresh meat. (stated preference method)	• Consumers purchases seemed to be more influenced by quality assurance labels coordinated by producers-leg organizations, and that recognition and knowledge of retail labels were low in comparison. • Thus, this study raised a question challenging the relevance and communication strategies of in-house retail 'quality assurances' to consumers.
Cason and Gangadharan (2002)	Examine the incentives that firms have to offer products of differing environmental quality to consumers.	An experimental auction market. (stated preference method)	• Caveat: Remember this was an experimental market with only 11 participants. • When a difficulty arises in determining the environmental quality of goods in a market, consumers may hesitate to pay a higher price for products that might be environmentally superior. • Government regulators or non-governmental organizations

Author	Objective	Source of data and method	Results and Conclusion
			can improve environmental performance by providing the option of certified green labelling.
Urala and Lahteenmaki (2003) *Place: Finland*	determine how consumers in Finland perceive the benefit of health-related claims that differ in strength, and how consumer's gender, age, level of education, trust in food-related information and frequency of use of so-called functional foods affect the perceived advantageousness of the health claims.	Mail questionnaires. (stated preference method)	• Health related claims were perceived as advantageous. • Women had more positive response to claims than men which may reflect their more positive attitude towards a healthy diet. • Respondents trusted information from authorities and manufacturers. • Providing more information about functional foods may not be the best solution for promoting them to consumers as the methods of reasoning is different from science based probabilistic thinking, information in itself may be interpreted in a simplistic manner that masks the product specific content of the message. • Consumers require information on the possible physiological or health effects, but this may

Author	Objective	Source of data and method	Results and Conclusion
			not be enough to distinguish and protect the product from its competitors.
Bennett, Anderson, and Blaney (2002)	Explore the links between the characteristics of a moral issue (i.e. cage legislation and live animal export legislation.), the degree of moral intensity/moral imperative associated with the issue, and people's stated willingness to pay for policy to address the issue.	An experimental survey. Contingent valuation method was used to estimate people's WTP of policy options with moral dimensions. (stated preference method)	• Increases in moral characteristics do appear to result in an increase in moral intensity and the degree of moral imperative associated with an issue • There was a positive link between moral intensity associated with an issue and people's stated WTP for policy to address the issue.
Phan-Huy, and Fawaz (2003) *Product: Meat*	Provide empirical evidence of how attitudes towards animal protection influence purchasing behaviour for meat produced in conventional production systems and animal friendly production systems and show the impact attitudes have on household meat consumption.	Two cross sectional surveys. (stated preference method)	• Animal-friendly husbandry is an important aspect of meat quality due to consumer perception of sensory quality and food safety; and as value added public good. • Meat needs to regain consumer confidence through improved transparency of production methods and ameliorating meat quality.
Fearne and Lavelle (1996a) *Product: eggs*	Establish consumer attitudes and perceptions on egg shopping habits; diet, health,	A survey was Conducted on 30 households. (stated preference method)	• Branding could have potential benefits for egg producers. • Mid-priced, welfare friendly

Author	Objective	Source of data and method	Results and Conclusion
Place: UK	and food safety; bird welfare and egg production; and branded concept.		eggs could have market success with proper marketing communication.
Fearne and Lavelle (1996b) *Product: eggs* *Place: UK*	Generate hypothesis on consumer attitudes and perception on egg shopping habits; diet, health, and food safety; bird welfare and egg production.	Survey questionnaires were administered. (stated preference method)	• Concerns over cholesterol and animal welfare are major threats to the long term growth of the shell market.
Maruyama and Kikuchi (2004) *Product: eggs* *Place: Matsudo, Japan*	Examine the risk-learning process through which individuals form their willingness to pay for egg safety.	A survey through mail. (stated preference method)	• The weight of prior risk belief is slightly smaller than that of new risk information in forming the posterior risk belief. This was at least true for three out of four models that were estimated.
Gerhardy and Ness (1994) *Product: eggs*	Examine consumer attribute trade-offs with respect to quality and freshness attributes of eggs.	Mail survey. Conjoint analysis method. (stated preference method)	• Products defined in terms of attributes make it possible to estimate consumer willingness to trade off one attribute for another. • It is possible for consumers to lack full understanding of implication of various alternatives for simple products like eggs.
Galarraga and Markandya (2000)	Estimate how much is paid for the fair trade/organic characteristics of coffee in the	Data was collected from five different British supermarkets. The hedonic approach and a Quality	• This study found that the presence of the "green" characteristic increased the

Author	Objective	Source of data and method	Results and Conclusion
Product: Fair trade/ Organic coffee *Place: UK*	British market. This study was meant to provide different ways that can be used to estimate and evaluate labelling policies.	Based Demand System model and the Almost Ideal Demand system. (revealed preference method)	price of an average grade coffee by 11.26%.
Andersen (2003) *Product: eggs* *Place: Denmark.*	Estimate the marginal willingness to pay for eggs carrying different labels in Denmark. Product: eggs	Panel data. Random Parameter Logit model. (revealed preference method)	• Issues with regard to animal welfare deferred among households. • Marginal willingness to pay for organic eggs was higher for organic eggs compared to free range, battery and barn eggs.
Schroder and McEachern (2004) *Product: meat*	Examine attitude towards meat production, value conflict management, label knowledge, and trustworthiness of consumers' agents.	Interviews were conducted on 30 female meat consumers. (stated preference method)	• Differentiation in the meat market was poor and that there existed weak quality signals. • Consumers require better information about food production which is presented in a value-neutral context
Nelson (2004) *Product: Genetically modified products*	Examine how consumer perceptions of risks influence decision making process.	Questionnaire. A principle component analysis technique was used for the analysis. (stated preference method)	• Consumers require clear communication on how to deal with the risks in question and coping strategies.
Brennan, Gallagher, and McEachern (2003)	Entailed in this paper is an overall examination of European Union countries	N/A	• Summary statistics include set target for organic agriculture, land dedicated to organic

Author	Objective	Source of data and method	Results and Conclusion
Product: organic meat	organic meat markets looking at consumer perceptions of organic meat markets (information, access, safety, choice, and representation).		production, and price premiums currently paid for organic meat products.
Guagnano (2001)	Test the ability of the Schwartz model of altruism can explain willingness to pay for recycled products.	Telephone survey. Analysis techniques included conceptual dimensions within the Schwartz Norm Activation Model, principle factor technique with Viramax rotation. Willingness to pay was calculated using a Path Analysis. (stated preference method)	• public may be willing to pay something extra for alternative goods which offers them no direct benefits.
Huang, Kan, and Fu (1999) *Product: hydroponically grown vegetables*	Determine the existence price premium consumers would be willing to pay for hydroponically grown vegetables (HGV) and the magnitude of premiums for consumers willing o pay them.	Survey was administered to households. A probit model and order probit model were used for the analysis. (stated preference method)	• Premiums consumers are WTP for reduced exposure to pesticides. Premiums are not homogeneous amongst different demographic groups.
Huffman, Shogren, Rousu, and Tegene (2003) *Products: genetically modified vegetable oil, tortilla chips and potatoes*	Examine how consumer WTP of food products (vegetable oil, tortilla chips, and potatoes) changed with the introduction of GM labels.	The study incorporated the use of experimental auction markets and randomized treatments of statistical experimental design. Regression analysis was used to calculate median WTP. (stated preference method)	• Respondents discounted GM label foods in the presence of non GM substitutes. • The introduction of GM labels resulted in a decrease in consumer willingness to pay.

Author	Objective	Source of data and method	Results and Conclusion
Moon, and Balasubramanian (2003) *Products: Cereal*	Examine the existence of price premium consumers in the U.S. and U.K. were WTP for breakfast cereals made from non-biotech ingredients.	Contingent valuation survey techniques using a close-ended and payment card format where used to assess consumer WTP. The U.S. survey was conducted through mail while the U.K. survey was conducted online. (stated preference method)	• Risk perception is a major influencing factor in determination of consumers WTP for non-biotech breakfast cereals. • Consumers who perceived a risk to human health or the environment; or had a negative view of multinational corporations expressed a WTP a premium. • Consumers' associated positive benefits from agribusiness technology were less likely to pay a premium to avoid bio-tech breakfast cereals.
Golub, Binkley, and Denbaly (2004) *Product: Orange Juice*	Examine purchasing patterns of one of the more successful nutritionally-enhanced food products, calcium enriched orange juice. Specifically the study examines whether consumers buy calcium enriched orange juice to maintain sufficient calcium intake or just because they have high demand for any	AC Nielsen HomeScan database. A multivariate analysis was used in this study. (revealed preference method)	• Households that purchased calcium juice tended to select more healthy and nutritious products. • Some consumers' buy calcium enriched orange juice because they do not drink milk. • A portion of the consumers bought calcium juice simply because they valued nutrition.

Author	Objective	Source of data and method	Results and Conclusion
	healthy food with better nutritious content.		
Huffman and Jensen (2004) *Product: margarine*	Evaluates consumer's preferences and choice of nutritionally enhanced food products based on economic, geographic, ethnic and other socioeconomic characteristics.	AC Nielsen 1999 HomeScan retail scanner data panel is used. Hedonic pricing method and probit model on the choice of margarine that promotes good health. (revealed preference method)	• Consumer choice on nutritional attributes is relatively complex. • Consumers chose a mix of products to meet their preferences for table spreads.
Schupp, Gillespie and Reed (1998)	(1) estimates consumer awareness and use of nutrition labels on packaged fresh meats by selected socioeconomic characteristics of households (2) To ascertain reasons for consumers choosing not to read nutrition labels when available on packaged meats.	A mail out survey. Logit and tabular analysis. (stated preference method)	• Encourage retailers to place nutrition labels on the packages such that reading time is minimal and /or to combine the labels with point of purchase nutrition information on highly visible signs. • Retailers should use labels with out regard to targeting specific market segments.
Smed and Jensen (2002)	Quantify the major determinants of the demand for fluid milk, including the relative importance of taste and healthiness, measured by the relative willingness to pay for such attributes.	Weekly household panel data from a representative panel of Danish food consumers. The Almost Ideal Demand System is used for the analysis. (revealed preference method)	• Introduction of a new milk type did not change consumer's preferences for other milks substantially. • There were differences in the willingness to pay for the different milk types based on the age group.
Harper and Henson	Investigated consumer	Interviews were conducted.	• One third of Italians decreased

Author	Objective	Source of data and method	Results and Conclusion
(2001)	concerns about farm animal welfare and the impact on food choice in the UK, Ireland, Italy, France and Germany.		the consumption of beef and veal mostly, followed by poultry, pork, lamb, eggs and milk. • Forty-five percent of Irish consumers reported that they had reduced consumption due to animal welfare concerns, with the greatest decrease being for beef, followed by poultry, eggs, pork, veal and lamb. • Thirty-eight percent of Germans reported that they had reduced consumption of animal based food due to concerns about animal welfare. • Twenty-two percent of British consumers reported that they had reduced consumption due to animal welfare concerns. • Thirty-two percent of French consumers reported decreases in consumption due to concerns about animal welfare starting with poultry, followed by beef, veal, eggs, pork, lamb and finally milk.

Author	Objective	Source of data and method	Results and Conclusion
Gerhardy and Ness (1994)	The focus of the study was the link between consumer preferences for alternative product concepts and products that can be offered by producers and retailers because they were/are commercially feasible. The assumptions of the model were: (1) products can be identified as a set of different attribute levels (2) alternative versions of the same product can be defined as a set of different attribute levels, (3) consumers evaluate the utility of attribute level combinations when making a purchase decision (4) when consumers choose between alternative products, they trade-off attribute level combinations	Conjoint analysis. A questionnaire was designed to solicit information on egg-buying behaviour and preferences, lifestyle and demographic indicators and consumer preferences for the nine alternative egg concepts.	• Even with regards to a product such as an egg, it is possible for consumers not to fully understand all the implications of the various attributes. • Freshness was the most important attribute. • It is likely that other attributes are not independent.
Batte, Beaverson, Hooker and Haab (2004)	Address customer's willingness to pay for alternative levels of organic content in breakfast cereals, customer purchase patterns	A survey data. Conditional logit model.	• Desire to avoid pesticide residues were the primary motives for purchasing organic foods. • High prices and a perceived

Author	Objective	Source of data and method	Results and Conclusion
	for organic foods, and customer opinions about the benefits of organic and other food characteristics.		lack of variety of organic foods where the most important reasons that consumers gave for nor purchasing organic foods. • Consumers are willing to pay premium prices for organic foods, even those with less than 100 percent organic ingredients. • Willingness to pay varied significantly among consumer groups. • Families with children aged 15 and younger were significantly less likely to select organic food products.
Latvala and Kola (2003)	(1) to assess how much consumers are willing to pay for meat products of which origin and production practices are known, especially with regard to safety issues (2) to compare the applicability, reliability, and efficiency of safety information provided by	Contingent valuation. The questionnaire had questions about consumers' buying and preparing habits of beef, whether the consumers pay attention to present labels and other information, risk perceptions, awareness of food safety risks and demographics.	• Consumers were concern about food borne diseases of animal origin compared to risk factors in food. • Consumers were willing to pay for additional information about safety and quality of beef products. • The future the demand for better information of all quality attributes of food

Author	Objective	Source of data and method	Results and Conclusion
	either private companies or public institution (3) to explore the possibility of the so called information paradox: that is to say more information is always better.		products will be satisfied to a growing extent by electronic databases and other electronic business means of modern information technology.
Maynard and Franklin (2003)	Elicit peoples willingness to pay for "cancer fighting" milk, butter, and yogurt.	Contingent valuation method.	• Households with children and health-conscious consumers appear most willing to pay premiums for cancer dairy products. • There is a profit potential for producers serving niche markets via small-scale processing ventures. • Consumer demand and the legality of health claims hinge on pending medical research outcomes.
Loureiro, McCluskey and Mittelhammer (1999)	Evaluate consumer response to labels that claim to have credence attributes.	The contingent valuation method and the hedonic method The data was collected with in person interviews and purchases in actual grocery stores. The socio-demographics variables that were considered included: presence of children under the age of 18, Family size, income, and gender while	• Consumers with children under the age of 18 and have strong environmental and food safety concerns are more likely to buy organic apples and vice versa. • Family size was found to have a negative impact on the likelihood of choosing organic.

Author	Objective	Source of data and method	Results and Conclusion
		variables such as race, age, and education were excluded from the empirical analysis because they were not statistically significant.	• Larger families may have been conditioned by their customary shopping behaviour towards being less likely to purchase organic products. • The presence of children in the household was significant and had a negative effect on the purchase of conventional apples.
Harper and Henson (2001)	Investigated consumer concerns about farm animal welfare and the impact on food choice in the UK, Ireland, Italy, France and Germany.	Interviews were conducted.	• One third of Italians decreased the consumption of beef and veal mostly, followed by poultry, pork, lamb, eggs and milk. • Forty-five percent of Irish consumers reported that they had reduced consumption due to animal welfare concerns, with the greatest decrease being for beef, followed by poultry, eggs, pork, veal and lamb. • Thirty-eight percent of Germans reported that they had reduced consumption of animal based food due to concerns about animal welfare. • Twenty-two percent of British

Author	Objective	Source of data and method	Results and Conclusion
			consumers reported that they had reduced consumption due to animal welfare concerns. • Thirty-two percent of French consumers reported decreases in consumption due to concerns about animal welfare starting with poultry, followed by beef, veal, eggs, pork, lamb and finally milk.
Travisi and Nijkamp (2004)	Estimate the value of some important pesticide-related environmental attributes, using a 'green shopping' payment vehicle.	conjoint choice experiment A conditional logit model	• Respondents were willing to accept substantial willingness to pay premiums for agricultural goods in particular foodstuffs produced in environmentally friendly ways.
Enneking (2004)	Investigates consumers' WTP for quality assurance labels particularly with regards to packaged liver sausages marked with a blue 'quality and safety' label.	Choice experiment. A conditional logit model.	• Quality labelling significantly affects consumers' choices and that WTP estimates vary across various brands.

Table 11. Summary of Relevant Canadian Studies

Author	Objective	Source of data and method	Results and Conclusion
Veeman and Adamowicz (2000) *Product: milk*	Assessment of the impact of the effects of various risk factors and perceptions, including pesticide residues and hormonal growth treatments on consumer's preferences for food. The detailed objectives of the study were to: (1) Assess the nature of risk perceptions of Albertans regarding selected biotechnological processes and chemical residues or additives. This was specified to involve (a) broad assessment and (b) a specific case study pertaining to milk from rBST treated cows. (2) Assess the likely impact of such perceptions on market demand (3) assess the regulatory processes that apply to the licensing of biotechnological processes and chemical residues or additives based on information from (1) and (2).	Focus groups, phone and mail surveys Conditional logit model The final variables used in estimating the final model were the alternative specific constants, price, rBST (a dummy variable indicating whether the milk presented in a scenario is from cows that have been treated with rBST), a variable capturing the freshness of milk, age of a respondent, gender, number of children in a household who are under the age of six, total household income before taxes, number of years of education completed by respondent and a dummy variable representing whether the respondent had knowledge of rBST prior to receiving the survey.	• Albertans were more concern about pesticide use in food production than about the use of hormones. • The higher ones education levels, the more likely Albertan were to choose restrict pesticides or hormones. Increasing food cost decreased the probability of choosing to restrict pesticides or hormone use. • Women perceived pesticide use in food production as a greater food safety risk than Men. • Age was significant for skimmed and homogenized milk and the coefficients were positive • Gender was positive and significant with regards to skimmed and 1 % milk. • For households with children the coefficient for 2% and homogenized milk were positive and significant. • Educated consumer was less

Author	Objective	Source of data and method	Results and Conclusion
			likely to purchase 1%, 2% and Homo milk. • Household income is negative and significant for Homo and 2% milk, and positive and significant for 1% milk. • Consumer demographics were found to have an impact on their choices of milk purchase.
Cranfield and Magnusson (2003)	Determine whether Canadian consumers would be willing to pay a premium for Pesticide Free Production (PFP) food products.	Contingent valuation survey was carried out in Toronto, Winnipeg and Calgary. The survey also collected demographic, attitudinal and behavioural information about respondents and their households. Number of children in a household to number of people, gender of respondent, age of respondent, education of respondent, and annual household income were some of the socio-demographic characteristics that were considered in the study. An ordered probit model was used to carry out the analysis	• 67 percent of respondents would be willing to pay a one to ten percent premium for PFP food product relative to a conventional food product. • Five percent of respondents would be willing to pay more than a 20 percent premium. • Consumers are more likely to pay a premium if they are younger, are willing to switch grocery stores to purchase a PFP food product, shop at health stores, are concerned about pesticides use in agriculture and food and are concerned over sustainability of traditional agricultural production at a small scale. • marketing efforts should focus

Author	Objective	Source of data and method	Results and Conclusion
			on reaching consumers who fit the above profile • Distribution channels geared towards health food stores are likely to emerge as a more successful avenue to market PFP food products. • Socio-demographic factors played a relatively unimportant role as compared to shopping behaviour and concern over pesticide use in agriculture in their study.
Magnusson and Cranfield (2005)	Analyze consumer response to the introduction of food products containing PFP inputs.	Consumer survey was used. The empirical model was estimated using the PROBIT command in SHAZAM.	• Indicate respondents have a strong interest in purchasing PFP version of the various food products. • Respondents indicated they would purchase a PFP version of food products ranged from 83% for pasta to 36% for buckwheat noodles. • More popular foods products include: pasta, breakfast cereal, whole wheat bread, multigrain bread, bagels and oatmeal. • Concern over pesticide use and its effect on the environment, willingness to switch grocery

Author	Objective	Source of data and method	Results and Conclusion
			stores to purchase a PFP product, being less than 36 years of age, having less than a graduate level of education, having average household income and being willing to pay a premium for PFP food product were factors that increased the probability of respondents choosing a PFP food product.
Brown, Cranfield and Henson (2005)	Develop a consumer risk tolerance index, and to adapt the willingness-to-pay framework to account for individuals' risk-related perceptions. Pervious analyses did not empirically relate willingness-to-pay analysis to the degree to which consumers are tolerant of food safety risks.	An experimental auction was used to collect data. A Tobit model was used for estimation. The dependent variables included Gender, risk tolerance index, information stage	• Individuals who are more tolerant of food-borne pathogens and related illnesses are willing-to-pay less for food safety improvements. • Illustrates the importance of accounting for risk-averting behaviour when conducting willingness to pay analysis. • Results were not sensitive to inclusion or exclusion of the gender dummy variable.

Author	Objective	Source of data and method	Results and Conclusion
Hobbs (2004)	Examines the economic incentive for implementing traceability systems in the meat and livestock sector, distinguishing between ex post trace back systems and ex ante quality verification system.	Uses experimental auctions Four different sandwiches were used in the auction, with different information available for each sandwich: (i) animal welfare assurance, (ii) extra food safety assurance, (iii) meat that was traceable to the farm of origin, and; (iv) a sandwich that combined all three attributes. A complete breakdown of the participant's demographics was collected. Impact of gender, age, education and income on individual's willingness to pay for traceability were studied.	• Participants were willing to pay $0.33 for a beef sandwich with food safety assurance, $0.27 for a beef sandwich with humane treatment assurances and lastly, $0.83 for a beef sandwich that bundled traceability with both quality assurances over the traceability only sandwich. • The four demographic variables were not statistically significant. • The pork (ham) results showed that participants were willing to pay $0.13 on average for a sandwich with humane animal treatment assurances, $0.09 premium for a sandwich with additional food safety assurance over the traceability-only sandwich and lastly, $0.28 for a sandwich that bundled traceability, food safety and production assurances. • Age, gender and income were not statistically significant. Education was statistically significant at 25% level. • Quality assurances with respect to food safety and on-farm

Author	Objective	Source of data and method	Results and Conclusion
			production methods for both beef and pork were more valuable to consumers that a simple traceability assurance. • High levels of trust in the public sector assurances about production methods relative to those from the private sector.

2.8. Conclusion

In conclusion, it is important to reiterate the importance of understanding demand and demand elasticities for policy makers, egg producers and processors. Previous studies have determined that the following factors affect egg demand: gender, family size, income, age, advertising, cholesterol information, food safety issues and media coverage, and price. In these studies it has been observed that consumer demographics and socio-economic characteristics have been changing with time and hence it is important to evaluate how these changes have affected tastes and preferences for shell eggs. Also, these studies identify the importance of accurately estimating demand parameters. It is not an easy task to find the best measure of price and income elasticity as much depends on the specification of the equation, and on the data being used for the analysis. It was also noted that elasticity estimates are not static but rather change over time. Thus, it is important to always update these elasticities since they have implications for policy makers, egg producers and egg processors.

Most of the earlier demand analyses were conducted with either time series or cross sectional data with only a limited degree of product disaggregation. Many demand studies have used food categories such as beef, pork, and poultry. Although beef, pork and poultry are substitutes, they are still much more aggregate than the level of disaggregation provided by panel data. The use of panel data allows for much more disaggregated level and thus, producing more robust estimates since the egg choice alternatives in this study are closer substitutes than those used in traditional/earlier demand studies.

Another issue that was discussed was the possibility that declining demand for shell eggs in the early 1980s through to mid-1990s was mainly due to health concerns. There was a lot of negative publicity that identified eggs as a major source of cholesterol that caused cardiovascular diseases. To deal with this negative press the egg industry invested money to investigate this connection between eggs and cholesterol. From these studies it was found that an egg a day did not pose any dangers to people's health. Also, it was identified that eggs were one of the natural foods that contained 13 essential nutrients required by humans. Due to these findings the egg industry, supported by provincial governments, launched numerous campaigns promoting eggs as a healthy food choice. Thus, studies in the 1990s focused on evaluating what the optimal advertising strategy would be for both the egg industry and provincial governments that funded these campaigns.

There has been increased research geared towards exploring different ways in which eggs could be modified and made even healthier. These explorations have led to the development of specialty foods such as omega-3 and vitamin enhanced foods. Issues with regard to peoples concerns on animal welfare and the outbreak of food borne disease led to consumer being concerned about the ways in which food was being produced. Thus, in order to avoid a decline in egg demand, the egg industry responded by developing specialty and value added egg products that addressed these particular individual concerns. However, the benefits of additional food safety, animal welfare requirements and environmental requirements to consumers have not been adequately studied in Canada in the past decade.

It can be argued that little is known about what product attributes Canadian consumers consider with regard to the already existing value added and specialty products, and it is towards filling this gap that this thesis is directed. Also, most of the studies that have dealt with the above issues were not done in Canada. With the exception of Hailu and Goddard (2004) and Brown et al (2005) there are no other studies that have dealt with above issues especially in relation to egg demand. Thus, this thesis will contribute to the earlier studies done in Canada. These studies dealt with issues of advertising, food and in particular egg demand and had encouraged R & D in the egg industry.

Addressed in this chapter was economic consumer theory, different types of analyses such as time series versus cross-sectional or cross-sectional versus longitudinal/panel or time series versus longitudinal/panel, previous studies both in Canada and outside Canada dealing with similar issues but with great emphasis on eggs. Also presented in this chapter were the economic concept of value, methods of measuring value (i.e. the stated and revealed preference methods were discussed); a brief overview on product differentiation.

In the case where consumers face very close substitutes, like the different egg types on the same supermarket shelf, the demands are not continuous. Choosing a particular product will likely result in zero expenditure on an alternative egg product during a shopping trip. The changes in demand are not smooth and many products are not purchased by a particular household. Therefore, it is appropriate that demand analysis be approached in a qualitative manner rather than a quantitative one. In this context, appropriate econometric models are used to explain the household's egg choice behaviour

as affected by demographic factors as well as the shopping habits. In the next chapter, the models and issues pertaining to the development of the models to be used in the analysis are discussed.

Chapter 3 Theoretical and Empirical Framework

3.0. Introduction

This chapter provided the theoretical framework on which to base an empirical analysis of egg consumption in Alberta. Given that most studies on differentiated products are based on stated preferences, this study is relies on market data or revealed preferences for consumers for the different egg product attributes. Thus, the theoretical background developed for this study should be able to capture the complexities associated with each household's choice set and their specific socioeconomic characteristics.

To motivate the empirical work, a modified Lancaster theory that assumes individuals derive utility from services/ properties/ characteristics provided by the commodities will be used. This approach is deemed relevant for the study of the Alberta egg industry because there is already a proliferation of differentiated shell egg products in the market. Thus, the notion that the various egg products depends on characteristics that satisfy consumers preferences for taste, nutrition, animal welfare, food safety and health concerns can easily be modeled. The estimates from the modeling process that are yielded from this study will be used to provide insights into pricing policies, consumer preference and labelling.

An important issue is the extent to which consumers are willing to shift their purchasing patterns through the different egg types. Understanding the factors that affect a consumer's purchasing behaviour is very important for the Canadian egg industry since consumer egg type selection may ultimately impact the price linkages seen among the various products. This chapter presents the actual methods and models that will be

estimated and used for carrying out simulations on household egg consumption data. Also presented is the information on the data that will be used for the study.

3.1. The Foundation for Choice Models such as Discrete Choice and Multinomial Logit, Nested Logit Models

The basic foundation of discrete choice modeling is slightly complex as it combines elements of several different economic theories. Discrete choice modeling is based on probabilistic choice theory, random utility theory and is consistent with Lancaster's economic theory of value and neoclassical economic theory. Thus, random utility theory allows the researcher to elicit preference for complex multidimensional goods, from which models of preferences can be estimated (Ben-Akiva and Lerman, 1985; Hall et. 2003).

The foundation of the probabilistic choice theory and modeling is that there is always uncertainty surrounding an individual's choices. Consequently the researcher cannot perfectly predict the individual choices. Thus, an important aspect of models dealing with uncertainty is that, instead of identifying one alternative as the chosen option, the researcher assigns to each alternative a probability of being chosen by a given consumer.

3.1.1. The Random Utility Model

The Random Utility Model (RUM) has a number of theoretical assumptions most of which have been presented in the discussions dealing with the economic theory. The first assumption assumed when using RUM is that individuals maximize their utility subject to their income and budget. Secondly, RUM adopts Lancaster's (Lancaster 1966) consumer theory in explaining demand. As discussed earlier, Lancaster's theory argues that people

derive utility from consuming the attributes of a goods or services rather than consuming the goods or services directly. The third assumption under RUM is that every choice decision is independent. This assumption ensures that the last decision has no impact on the current one.

The choice of an alternative i by individual n is one from a finite set of alternatives in an individual's choice set C_n. A rational individual n chooses an alternative i such that the utility obtained from consuming i is greater than or equal to the utility obtained from consuming any other alternative j in the choice set C_n. In RUM, the utility of individual n choosing commodity i , U_{in}, has two parts, indirect utility, V_{in} , that is observable and can be explained, and a random component, ε_{in}, that captures the effects of unobserved and omitted influences such as omitted variables, measurement errors and imperfect information (Ben-Akiva and Lerman, 1985). Thus, in RUM the expected utility of a good is viewed as a function of the attributes of the good, the relevant characteristics of the decision maker and a random component. This can be written as follows:

$$U_{in} = V_{in} + \varepsilon_{in} \qquad (3.1)$$

where U_{in} is the true but unobservable consumer $n's$ utility for alternative i, V_{in} is the observable systematic component of utility and ε_{it} is the factor unobservable to the researcher and is treated as a random component. Thus, V_{in} becomes the explainable portion of the variance in choice which is used to explain to predict individual's choices.

$$V_{in} = \beta X_n + \beta_i Z_{in} \qquad (3.2)$$

where X_n is a vector of characteristics of the consumer and Z_{in} is a vector of the attributes of alternative i and ε_{in} is the unexplainable part of the utility function. Notice

that ε_{in} is subscripted by i and n. This means that we have one disturbance per individual per choice. Random utility theory always assumes that the individual is a utility maximizer. Since the researcher cannot observe the true utility function, a probabilistic utility function is used in the estimation process. The appropriate probabilistic choice model to apply depends on the assumptions made about the random component. This issue is discussed later on in this chapter. Assuming that an individual chooses between two alternatives, i and j, the probability that alternative i is chosen is given by:

$$\begin{aligned} P_n(i \mid C_n) &= P_r(U_{in} \geq U_{jn}) \\ &= \Pr(V_{in} + \varepsilon_{in} \geq V_{jn} + \varepsilon_{jn}) \\ &= \Pr(V_{in} - V_{jn} \geq \varepsilon_{jn} - \varepsilon_{in}) \end{aligned}$$

$$\forall j \neq i, j \in C_n \qquad (3.3)$$

From this expression, it can be seen that the higher the probability for choosing an alternative, the larger the difference between the observed utilities. The input data used in this model are the observed choices, while the output or results obtained from the analysis are the differences in the utilities for the two alternatives $(V_{in} - V_{jn})$. Thus, every individual makes a discrete choice and chooses either alternative i or j.

Random utility models are obtained by specifying a distribution for the error terms (ε_{in} in equation 3.2). Assuming that the error terms are identically and independently distributed with a Weibull distribution implies that the residuals ($\varepsilon_{in} - \varepsilon_{jn}$) have the form

$$F(\varepsilon_{jn}) = \exp(\exp-(\varepsilon_{jn})) \qquad (3.3)$$

Thus, the probability of choosing a particular egg type j for household n is given as follows:

$$\Pr_{jn} = \Pr(C_{jn} = 1) = \Pr(\varepsilon_{in} \leq \varepsilon_{jn} + V_{jn} - V_{in}) \forall\ i \neq j$$

$$= \int_{-\infty}^{\infty} \prod_{i \neq j} F(\varepsilon_{jn} + V_{jn} - V_{in}) * f(\varepsilon_{jn}) \partial \varepsilon_{jn} \qquad (3.4)$$

where the F and f are cumulative and density functions which are identically and independently distributed (idd) with a Weibull distribution (Type I extreme-value) respectively.

In some choice scenarios utility depends on characteristics which vary across individuals, and attributes which vary across alternatives. Individuals of varying ages, income, and household size and with or without children choosing between eggs of varying prices and types provide an example of such a situation. The conditional logit model was formulated for such scenarios (Greene 1991). In the conditional logit model, utility depends on Z_{int} which is the attribute characteristic specific to the choice and X_n is the characteristic/characteristics specific to the individual. Thus, Z_{in} varies across the choices while X_n does not. Taking the integral of equation (3.3) using the approach that McFadden (1974) employs, yields household $n's$ choice probability of the Jth alternative at time t. The expression is shown below:

$$prob\ [C_n = j] = \frac{e^{V_{jn}}}{\sum_{j=1}^{J} e^{V_{jn}}} = \frac{e^{\beta X_n + \alpha_j Z_{nj}}}{\sum_{j=1}^{J} e^{\beta X_n + \alpha_j Z_{nj}}} \qquad (3.5)$$

where β and α are parameters to be estimated.

3.1.2. The Conditional Logit Model

This section of the study is concerned with the household's decision to purchase eggs and the effect that the four consumer concerns mentioned in Chapter 1 might have

on this decision. It is assumed that all the egg types are mutually exclusive[15] . Thus, it will be assumed that a household decides whether to purchase eggs or not to purchase eggs on a particular shopping trip. Thus, at one purchase occasion the consumer evaluates the attributes of the egg types present and chooses to purchase one or more types of eggs or neither type. In this study it is assumed that each egg type contains a unique characteristic that may cause a household to change their usual egg purchasing behaviour, for example, to buy omega-3 eggs as opposed to the usual purchase of normal eggs, or the consumer may decide not to purchase any eggs at all.

The egg purchase decision is assumed to be based on constrained utility maximization, as is shown in the indirect utility functions shown below. These functions are linear in parameters and their arguments include price as a vector of the attributes of eggs and the socio-economic characteristics of individual n; and the $\beta's$ are the vectors of the unknown parameters. The postulated indirect utility functions for the five different types of eggs including the no purchase option are:

$$V_{1n} = ASCN + \beta' PRC_{jn} + \beta' HSZ_n + \beta' HAGE_n + \beta' POC_n + \beta' TE_n \quad (3.6)$$
$$V_{2n} = ASCOM + \beta' PRC_{jn} + \beta' HSZ_n + \beta' HAGE_n + \beta' POC_n + \beta' TE_n \quad (3.7)$$
$$V_{3n} = ASCF + \beta' PRC_{jn} + \beta' HSZ_n + \beta' HAGE_n + \beta' POC_n + \beta' TE_n \quad (3.8)$$
$$V_{4n} = ASCOR + \beta' PRC_{jn} + \beta' HSZ_n + \beta' HAGE_n + \beta' POC_n + \beta' TE_n \quad (3.9)$$
$$V_{5n} = ASCV + \beta' PRC_{jn} + \beta' HSZ_n + \beta' HAGE_n + \beta' POC_n + \beta' TE_n \quad (3.10)$$

where subscript 1 denotes "none", 2 denotes omega-3 egg, 3 denotes free run/range egg, 4 denotes organic egg, 5 denotes vitamin enhanced egg and 6 denotes normal egg. In this

[15] In probability theory, events E1, E2, ..., En are said to be mutually exclusive if the occurrence of any one them automatically implies the non-occurrence of the remaining n – 1 events. In other words, two mutually exclusive events cannot both occur.

specification, the ASC represent the alternative specific constants[16] associated with each alternative. In the conditional logit models the socioeconomic variables do not vary across the alternatives and therefore must be expressed as alternative specific. That is to each of the socio-economic variables is interacted with the ASC so that now the variables denoting age, presence of children, total expenditure, household size and income are each expressed as variables that are specific to each alternative. Using presence of children as an example, there will now be five household size coefficients in the model: POCN, POCOM, POCFR, POCOR and POCV. The coefficient POCN expresses the effect of presence of children in a household on the probability of choosing to purchase normal eggs relative to the base case (choosing not to purchase any egg type) while POCOM, POCFR, POCOR and POCV express the effect of presence of children in a household on the probability of choosing omega 3, free range/run, organic and vitamin enhanced eggs respectively. PRICE is already expressed as an alternative specific variable. Table 11 provides the name of each variable in each alternative. In Table 12 provides an overview of what the final results from the estimation process is provided.

[16] The ASC is also called the fixed effect for a product in a particular market that incorporates the average value of the omitted attributes along with the other components of utility that do not vary in the market. Also, the ASC can be described as the utility associated with a particular alternative.

Table 12. Variable Definitions

ASCN	An alternative specific constant representing the utility associated with normal egg
ASCOM	An alternative specific constant representing the utility associated with omega 3 egg
ASCF	An alternative specific constant representing the utility associated with free run/range egg
ASCOR	An alternative specific constant representing the utility associated with organic egg
ASCV	An alternative specific constant representing the utility associated with vitamin enhanced egg
PRC	The price per dozen for respective egg types
HINC	Household income
HAGE	Age of the head of the household
POC	Presence of children. Under 18 =1, 0 otherwise
TE	Total food expenditure(all foods including eggs)

Table 12. Variable Definitions by Egg Type

Variable	Alternatives and Coefficient Names				
	Omega-3	Free run	Organic	Vitamin	Normal
PRICE	$PRICE_{om}$	$PRICE_{fr}$	$PRICE_{og}$	$PRICE_{v}$	$PRICE_{n}$
SIZE	HSZOM	HSZF	HSZOR	HSZV	HSZN
INCOME	HINCOM	HINCF	HINCOR	HINCV	HINCN
AGE	HAGEOM	HAGEF	HAGEOR	HAGEV	HAGEN
CHILDREN	POCOM	POCF	POCOR	POCV	POCN
EXPENDITURE	TEOM	TEF	TEOR	TEV	TEN

It is worth noting that in conditional logit models the coefficients are indicative of the sign of the marginal impacts of the attributes. The marginal probability of a change in attribute k is equal to (1-Pi)*Pi ßk where Pi is the probability of choice i and ßk is the

coefficient of attribute k. If the marginal probabilities are calculated at the mean values of the independent variables, the marginal probability is simply the coefficient times a constant for each alternative. Thus, in the literature that employs conditional logit models; most researchers report only the coefficients. This practice is replicated here. For the purpose of this study, the cross and own elasticities[17] of choice probabilities are calculated rather than the marginal probabilities[18].

Once the estimated parameter vector is obtained, the own and cross elasticities of choice probabilities for egg type can be calculated as:

$$E_{X_{iqk}}^{P_i} = \frac{\partial P_{iq}}{\partial X_{iqk}} * \frac{\overline{X}_{iq}}{\overline{P}_{iq}} \qquad (3.11)$$

where P_i is the overall estimated probability of choice for egg type i. The interesting result is that the cross elasticity does not depend on i. This is due to the property of independence of irrelevant alternatives (IIA) and implies that all cross elasticities are equal.

3.2. Independence of Irrelevant Alternatives Assumption

The assumption of independence of irrelevant alternatives (IIA) underlies the MNL model. The assumption follows that the disturbances are independent and identical and as such, the log odd ratio of any two alternatives is independent of the utilities of other alternatives (Greene, 1997; McFadden, 2001). This assumption requires that the sources of errors contributing to the disturbances must do so in such a way that the total

[17] Elasticity is defined as a unitless measure that describes the relationship between the percentage change of some variable and the percentage change in quantity demand, *ceteris paribus* (Hensher, Rose and Greene, 2005).

[18] Marginal effects reflect the rate of change in one variable relative to the rate of change in a second variable. And, unlike elasticities, marginal effects are not expressed as percentage changes but rather they are expressed as unit changes (Hensher, Rose and Greene, 2005).

disturbances are independent, otherwise the MNL will generate incorrect predictions of probabilities (Ben-Akiva and Lerman, 1985). It is straight forward to demonstrate that the IIA holds for the MNL model:

$$\frac{P_i}{P_j} = \frac{\dfrac{e^{v_{ni}}}{\sum_j e^{v_{nj}}}}{\dfrac{e^{v_{nj}}}{\sum_j e^{v_{nj}}}} = \frac{e^{v_{ni}}}{e^{v_{nj}}} \tag{3.12}$$

The IIA assumptions provides some clear advantages such as it makes the MNL model very simple to operate, for instance, it allows a researcher to introduce a new product alternative without having to re-estimate the model. However, the IIA assumption has some serious shortcomings. For instance when observed and unobserved attributes of utility are not independent of one another and/or if the unobserved components of utility are correlated among alternatives, this may lead to having biased utility parameters and forecast errors. This property has been found to be restrictive towards household behaviour. Blake, Bicknell and Saunders (2005) state that although this is assumption is widely used, it is unclear exactly how much bias this property introduces into the MNL results.

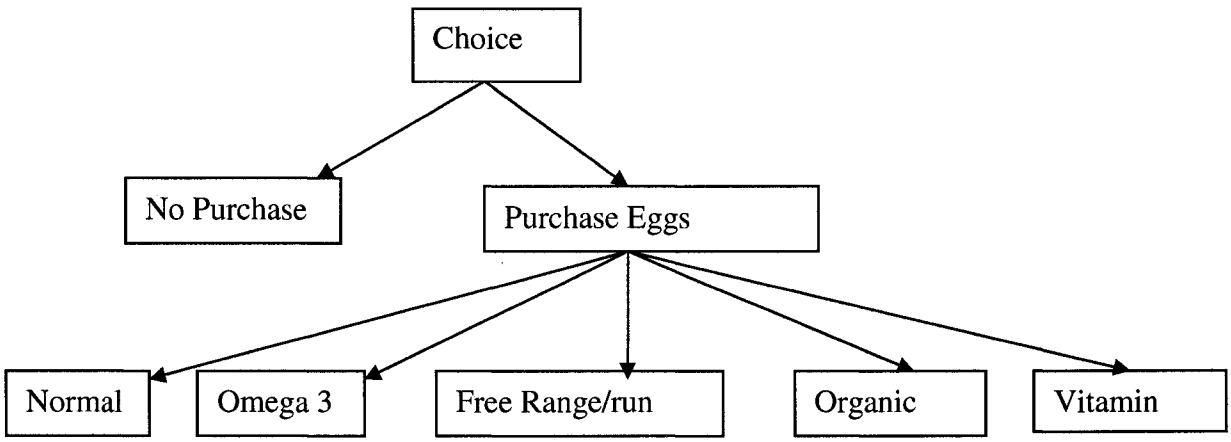
Louviere (2001) argues that even with the assumptions of IIA the MNL is still very useful and robust. Louviere argues that the violation of IIA can be avoided by the inclusion of interactions variables such as socio-demographics. Also, the assumption can be avoided by using more complex models such as the nested logit, multinomial probit and the random parameter logit model. In thesis, the nested logit model will be explored as an alternative to the MNL model.

3.3. Nested Logit Model

The nested logit model (NLM) is a generalization of the multinomial logit model that allows for a particular pattern of correlation in unobserved utility. Consequently, Train (2003) states that the NLM is appropriate when the set of alternatives faced by a decision maker can be broken down into groups, called nests. In the case of this study a nested structure suggest that a household initially chooses between buying eggs and not to buy eggs and then subsequently choose between the different egg types if buying eggs nest is chosen.

Figure 8. A Comparison of the Nested Logit Structure and the Conditional/Multinomial Logit Structure

Nested logit structure[19]



[19] Household is ***not*** assumed to choose sequentially. Diagram simply represents nesting patterns and structure of system of logit models.

MNL structure

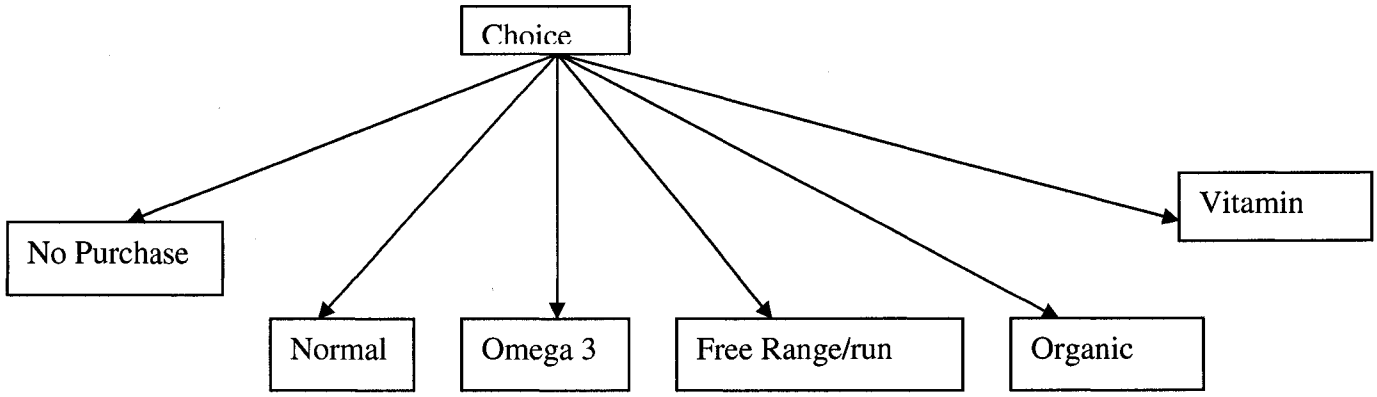


Figure 8 shows a hierarchical or nested decision structure for egg types. The household's choice of whether or not to purchase egg (i=1,2) provides a transition to the nest decision node of selecting among the different egg types (j=1,2,3,4,5,6) i.e. normal, omega 3,free range/run, organic and vitamin enhanced eggs. The choices on the lower branches of the tree are conditioned on prior choices at each transition node.

The properties of the nested logit model are that within a nest the IIA holds, whereas IIA does not hold between nests. Subsequently, the nested logit model thus provides a way to link different but interdependent decisions, and to decompose a single decision to minimize the restriction of equal cross-alternative substitution (Kjaer, 2005). Louviere et al. (2000) also state that the nested logit model provides a way to identify the behavioral relationship between choices at each level of the nest, and also enables the researcher to test the consistency of the nested structure with random utility maximization.

Like the MNL model the nested logit model of behaviour is based on random utility theory where the decision making process can be broken down into deciding: (1) not to buy eggs, (2) buying eggs options. For the decision to purchase eggs, the

deterministic component is defined as a function of egg attributes and the socio-economic demographics of the household;

$$V_{ni|P} = ASC_i + \beta' X_i \quad (3.13)$$

where n represents the individual, i the egg type chosen given a decision has been made to purchase eggs, p, X_i is the vector of attributes of the respective egg types, and β the parameters of the model to be estimated. With reference to this study, and Table 9, Equation (3.12) can be defined as:

$$V_{ni|p} = ASC + \beta' PRC + \beta' HINC + \beta' HAGE + \beta' POC + \beta' TE \quad (3.14)$$

where all attributes are defined in Table 9.

The deterministic component of the decision of whether or not to purchase eggs can be modelled as a function of both individual characteristics and the expected utility of the egg type chosen. Expected utility for each household, defined also as the log-sum or inclusive value, is defined as:

$$IV = \ln \sum e^{V_{ni|p}} \quad (3.15)$$

Thus,

$$V_{ip} = \partial' X_i + \lambda E[\ln \sum e^{V_{ni|p}}] \,, \quad (3.16)$$

where Xi represents the characteristics of the individual and the egg type (as described in equation 3.13 and Table 9) and ∂ a vector of parameters to be estimated.

In Equation (3.15), λ is the coefficient of the inclusive value. Thus, the IV defines a utility index associated with a partitioned set of alternatives and it represents the expected utility that a particular household gains from the choice among the alternatives

in the nest. Also, λ reflects the degree of independence among the unobserved portion of utility for alternatives in nest (Kjaer, 2005).

For the nested logit model to be consistent with utility theory, λ must lie between zero and one. When the coefficient tends towards one, the correlation among the unobserved components of utility for the alternatives within a nest decreases: and at the value of one, no correlation exists and the choice probabilities become a Multinomial logit model (Hensher, Rose and Greene, 2005; Kling and Thomson, 1996, Ryan and Skatun, 2004). Hensher, Rose and Greene (2005) note that if a similar model specification as that estimated in a nested logit with an inclusive value that is equal to one is estimated in the MNL and a Hausman –test is undertaken, one would observe that the MNL they have estimate conforms to IID (identically and independently distributed) assumptions and hence IIA holds. Thus, testing the constraint λ =1 is similar testing whether the standard MNL model is a better specification than the general nested logit model. If λ =0, then one can concluded that no independence exists between the nests and the decision can be said to be separated into distinct strategies (Hensher, Rose and Greene, 2005; Kjaer, 2005; Kling and Thomson, 1996, Ryan and Skatun, 2004).

Morey, Rowe and Watson (1993) used a nested logit model for individuals contemplating salmon finishing. The nested-logit was structured by participation and site choice: whether to go out to fish; if individual fishes, in which region; and where within the selected region. Similarly, Ryan and Skatun (2004) used a nested logit model in the examination of cervical screening. Park and Senauer (1996) used both the multinomial logit model and the nested logit model to analyze brand size choices for spaghetti. Park and Senauer (1996) brand selection involved three stage decisions. In the first step

decision, the household chooses between purchasing or not purchasing spaghetti. The second step decision is to decide which brand to buy under the condition that the purchase alternative was chosen. The third step decision is to decide which package size alternative to purchase under the condition that the brand was chosen. The tree structure adopted in this study is quite similar the one that was adopted by Park and Senauer (1996). The difference however, is that this study involves two step decisions while the study by Park and Senauer had three step decisions.

3.4. Sequential versus Full Information Likelihood Estimation

Nested structures such as those shown in Figure 8 can be estimated sequentially (sequential nested logit) or simultaneously (Full Information Maximum Likelihood (FIML). For sequential estimation the conditional choices(s) are estimated as MNL model, and then inclusive values are calculated for the universal set and included as exogenous variables in the marginal choice which is also estimated as an MNL model. However, the sequential approach has been found to lose efficiency in the estimation procedure because it replicates coefficients (Henser, 1986). Thus, an alternative approach is to estimate the model as a FIML nested logit obtaining fully efficient estimates. Thus, the analyst fits the entire model all at once, imposing all restrictions.

Kling and Thomson (1996) argue state that FIML estimation has several advantages over sequential estimation. Kling and Thomson (1996) state that sequential estimation constraints the researcher's choice of variables, due to difficult of including variables that do not vary across all levels of nests. Kling and Thomson (1996) also state that sequential estimation is also less amenable to accommodating variations in parameter values across levels of the nests. Kling and Thomson (1996) have also found that FIML

estimators produce significantly different coefficients from sequential estimation. For the above reasons, FIML estimation is selected for the analysis in this thesis.

3.5. Conclusion

In conclusion, the basis of this chapter was to introduce the underlying assumptions of the model that is going to be used in this study. The conditional logit model and nested logit model are specified to find the effect consumers' demographic and socio-economic characteristics have on the probability of selecting the respective egg types. These demographics are consequently used to characterize different households' willingness to pay for the respective egg types.

Chapter 4 Data and Hypotheses

This chapter begins with a brief outline of the model postulated to explain choice. This is followed by discussion of the data to be used. This is then followed by a discussion of hypothesized explanatory variables and *a priori* expectations of results. Presented in the final section are the discussion of results and willingness to pay estimates.

4.0. Overview

This study follows the argument of Baltzer (2004) that each of the egg types possesses a unique mix of quality attributes that may be identified by the consumer through a label at the time of purchase. It may be that free run and free-range egg are characterised by increasing concerns regarding animal welfare production relative to normal eggs (space, access to outdoor areas, etc.). The organic production method employed in the production of organic eggs may be regarded as a specific mix of quality attributes, such as animal welfare, environmental and health (food safety) relative to normal eggs. Omega-3 eggs and vitamin enhanced eggs have, as attributes, health claims. These five egg types are viewed as comprising a number of discrete egg bundles. The discrete egg type bundles under consideration and the names by which these choices are designated in the model (3.6-3.11) are (1) "neither", (2) omega-3 egg, (3) free range/run egg, (4) organic egg, (5) and vitamin enhanced egg. The "neither" option represents a situation where no egg type was purchased. The choices of the various eggs are then analyzed in the conditional logit choice framework. From the discussion in Chapter 3 on discrete choice modeling and random utility theory, we assume that a given egg type i will be chosen if the utility gained from choosing i is greater than or equal to

the utility gained from choosing any other alternate bundle j , with some random component.

It is assumed that the indirect utility can be inferred from the choices made by households/individuals. Consequently, it is hypothesized that the characteristics of the households or individuals and the prices of the egg types are the explanatory variables of the indirect utility functions and the arguments of the conditional/multinomial choice models. In this study, when choosing between egg types, consumers' varying ages, incomes, household size and other factors reflect their heterogeneities in tastes. Economic theory supported by information from previous studies and a *priori* reasoning indicate the importance of socio-economic variables that may influence individual or household shell egg purchasing decisions. For instance a study by Lin (1995) which evaluated individual's attitudes towards food safety found a link between age, household income, gender, marital status, education level and household size and individual's choices.

4.1. Data

Provided in this section is a summary description of the population under study. In this thesis we estimate our model on consumer's product choice using Homescan panel data provided by ACNielsen[20]. Individual households provided information on egg product purchases. In total 2635 households were observed in Alberta. The data on shell eggs and egg product purchases was collected on a four week cycle from various grocery stores starting with purchases from the week ending 02/02/2002 until the week ending

[20] ACNielsen provides scanners to selected households which they use to scan their purchases after returning from shopping. ACNielsen uses a separate survey to collect household information from participating consumers.

01/01/2005 (which is equivalent to a period of 39 months)[21]. Information on five demographic variables was also collected and provided along with the information on prices. These demographic variables are household income, household size, age of the head of the household, presence of children, total expenditure and language spoken. It is noteworthy that the full data set included more than shell egg purchases. However, for this analysis the study was limited to purchases of shell eggs for a total of 11459 observations. Five choice alternatives were selected: (1) normal eggs (2) omega-3 eggs (3) free range/free run eggs (4) organic eggs (5) vitamin enhanced eggs.

It should also be noted that omega-3 eggs, free range eggs, free run eggs and organic eggs were the only defined products in the data file. The vitamin-enhanced and normal eggs had to be identified and labelled accordingly. This identification process was made possible due to the provision of UPC codes (the bar code on the package), the name of the manufacturer of a particular product and the product brand name in the data set (see Appendix 5). Because of the provision of the name of the manufacturer and the product brand name, it was possible to do an internet search and find the producers or manufacturers of some of the egg products. On these websites most of the manufacturers had descriptions of the products they produced. This helped in determining whether a particular shell egg product was normal, vitamin-enhanced, omega 3, free range/run or organic. Once a product was identified, the UPC codes helped with the identification of the products within the data set since each product has a unique UPC code.

Eggs come in different sizes and packages. To incorporate this factor into the model, all the different packages of eggs (6 pack, 18 pack and 30 pack) were normalized

[21] It is worth noting that people can purchase eggs from other sources not recorded here such as farmer's markets and convenience stores.

to a dozen. The prices of all these products were added and then averaged to get the average weighted price for the different egg types for each period. Egg size was ignored when doing the weighting and one product was generated labelled as normal, omega-3, free range/run, organic or vitamin enhanced egg. Similar approaches have been used in studies of milk purchasing where 1% and 2% milk were counted as one category (Chen and Chen, 2000). Also, for this study, since we are only interested in the demand for shell eggs, all purchases of processed eggs are omitted from the sample data.

One of the tasks involved in using panel data is with the construction of the vector prices faced by each consumer on each purchase occasion. The basic problem is that one only observes the price paid by the consumer for the egg type that he/she actually purchased. Prices for other products are inferred. If it was the case that a panellist did not purchase any of the alternatives during a particular month, we used the average price of that particular egg type experienced by other panellists in that month as the price that he or she could have faced had he/she decided to purchase a particular egg type[22]. Baltzer (2004) used a similar approach when he was faced with the missing values for price. Baltzer argues that this solution has the advantage of being theoretically plausible as well as having no impact on the parameter estimates.

Studies by Keane (1997) and Park and Senauer (1996) presented other methods that have been used to replace the missing prices. Keane (1997) used three approaches to deal with the missing prices. He first sorted through all data for a particular store on a particular day; if a consumer was found who bought a particular brand, Keane uses the marked price the consumer faced as the marked price for that brand in that store on that

[22] It is worth noting that the average prices where calculated using the sample of 2635 households and not the 292 households which were considered in this thesis.

day. If no one bought a particular brand in a particular store in a particular day, Keane then looked for purchases in adjacent days to fill in the price and if no one bought a particular brand in a particular week, then Keane looked for purchases in adjacent weeks to fill in the price. Keane's approach was made possible because the Nielsen data he had included price files that contained prices for each brand in each store on each day of the sample while this is not the case with our data. We cannot locate specific locations where each consumer purchased their eggs. Park and Senauer (1996) simply use the previous price faced by such a consumer to fill in the missing prices.

Table 14. Average Prices for the Shell Egg Products

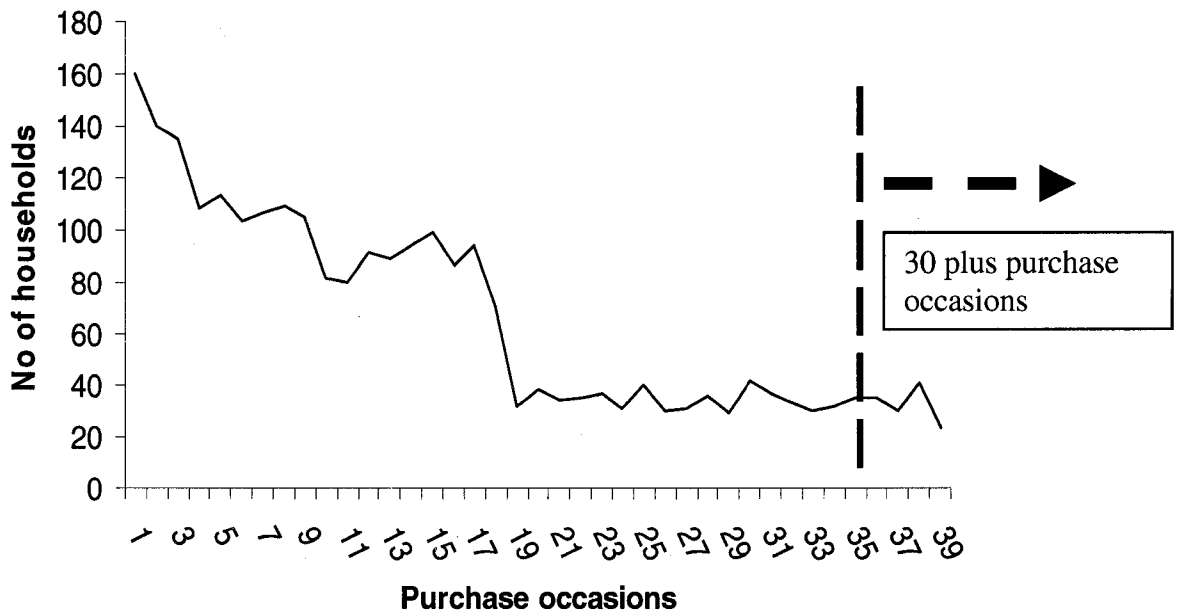
	Mean	Std. Deviation
Normal	1.62	0.07
Vitamin	2.33	0.35
Free Range/Run	2.28	0.37
Omega 3	2.51	0.10
Organic	2.62	0.18

Table 14 shows the average price of non-normal eggs to be higher than that of normal eggs. The higher prices associated with the non-normal eggs may be a reflection of pricing strategies by retailers and processors. The higher prices may also be a reflection of the high costs associated with producing eggs with additional attributes. These prices are also a clear approximation of the prices in the Alberta shell egg market (see Table 4 and 5 in Chapter 1 showing the prices of egg products in Safeway and Save on Foods grocery stores). However, the range of the prices in Table 14 is much smaller compared to the range found at a particular grocery store as is shown by Tables 4 and 5 in chapter one. The difference in the price range may be due to the fact that Table 14 represents the

average price over the entire time period being observed while Tables 4 and 5 show the prices at a particular time in the respective grocery stores.

For the purposes of the present models, it was decided to limit the sample to households who are regular purchasers of shell eggs. A careful inspection of the data revealed that some households were heavy egg consumers for several months and then never purchased eggs again. It is not clear if this is because households actually stopped buying eggs, or because of some problem with the data[23]. In order to obtain a sample of households[24] who appeared to be regular participants in the egg market throughout the 39 months, households were only included in the sample if they purchased eggs more than 30 times out of the 39 time periods (Figure 9).

Figure 9. Summary of Purchase Occasions[25] Based on the 2635 Households



[23] When faced by a similar situation Erdem et al. (2003) chose to speculate that either the households had moved out of the area of study but wasn't recorded or perhaps that the ID cards malfunctioned for some of the households.

[24] In total only 292 out of 2635 households in Alberta were used for the study.

[25] A purchase occasion is defined as a trip to the grocery store per month. In our data set, we had 39 months. Thus, the maximum purchase occasions a household could have is 39.

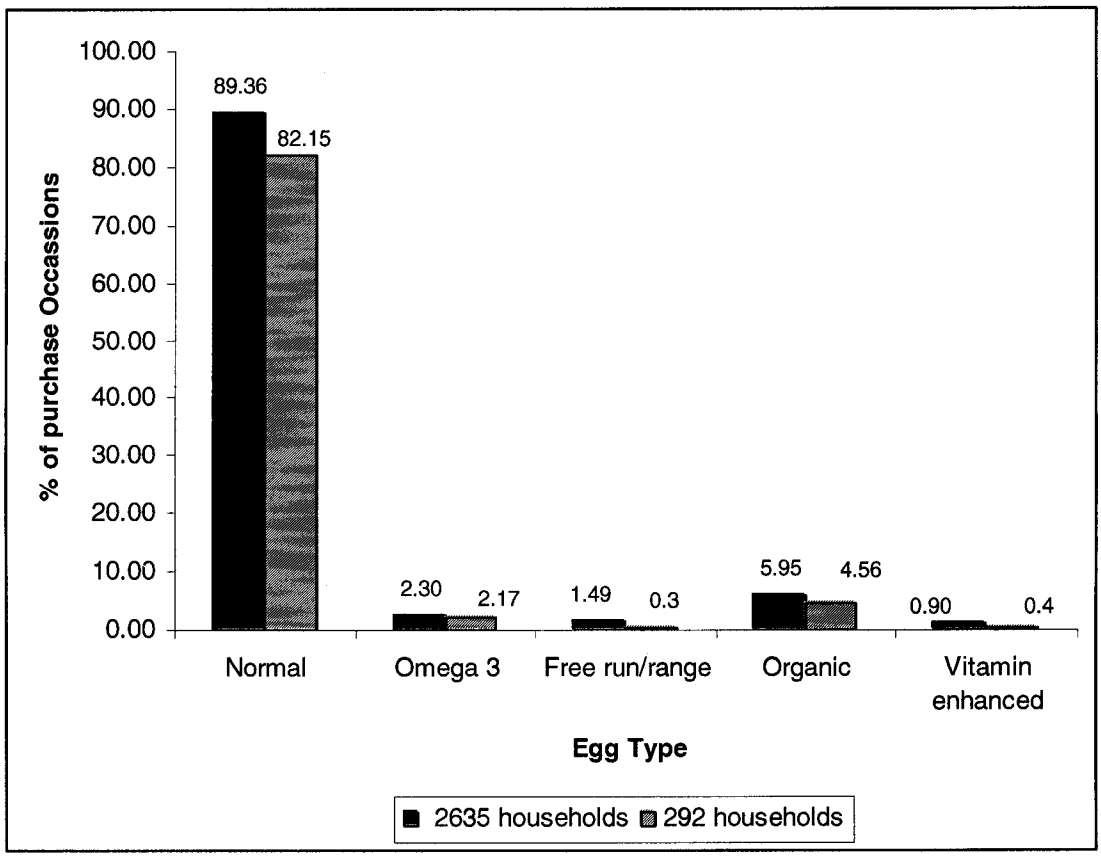
Also, provided in the data set was information on total expenditure on all composite foods per household based on a 13 month period. Those households that had 13 or 26 month periods where total expenditure was $0 were deleted from the sample since this was a clear indication that they were not participants in the sample during those particular months. These manipulations reduced the sample from 2635 households to 292 households. Table 15 shows the purchasing combinations of the various egg types based on the 39 months.

Table 15. Shell Egg Purchase Combinations, Alberta Purchases

Egg Purchase	Original Data File	Sample Data
One Type		
Normal	1830	155
Omega	8	-
Free Range/Run	6	-
Organic	13	-
Total	*1857*	155
Two Types		
Normal\Free Range	48	2
Normal\Omega	59	7
Normal\Organic	480	94
Normal\Vitamin	15	3
Omega\Free Range	6	-
Omega\Organic	2	1
Omega\Vitamin	3	-
Free Range\Organic	2	-
Free Range\Vitamin	2	-
Organic\ Vitamin	1	-
Total	*618*	107
Three Types		
Normal\Free Range\Organic	18	4
Normal\Free Range\Vitamin	4	-
Normal\Omega\Free Range	10	-
Normal\Omega\Organic	35	9
Normal\Omega\Vitamin	18	6
Normal\Organic\Vitamin	10	1
Omega\Free Range\Organic	4	-
Omega\Free Range\Vitamin	1	-
Omega\Organic\Vitamin	1	-
Free\Organic\Vitamin	1	-
Total	*102*	20
Four Types		
Normal\Free Range\Organic\Vitamin	7	3
Normal\omega 3\Free range\organic	17	1
Normal\Omega \Free Range\Vitamin	5	-
Normal\Omega \Organic\Vitamin	15	2
Omega\Free Range\Organic\Vitamin	2	-
Total	*46*	6
Five Types		
Normal\Omega 3\Free Range\Organic\Vitamin	*12*	4
Total Number Of Households	***2635***	***292***

Based on Table 15, 1857 households purchased one type of egg, 618 households purchased two types of eggs, 102 households purchased three types of eggs, 46 household purchased four types of eggs and lastly, 12 household purchased all the types of eggs in the given time period. The number of households that purchase normal eggs and some type of non-normal egg is high compared to households that purchase more than one type of non-normal egg this is also true when only 292 households are observed. It should also be noted that after the above data manipulations the very small product combinations were lost. This however, should not create any bias as the purchase of most of these combinations was already small when we observe the sample data with 2635 households (Table 15).

Figure 10. Comparing the Percentage of Eggs Purchased by Type for 2635 and 292 Households.



From Figure 10, for the 292 households there were 247 (2.17%) purchase occasions for omega-3 eggs compared to 263 (2.30%) purchase occasions for the 2635 households, 33 (0.30%) purchase occasions for free run/range eggs for the 292 households compared to 171 (1.5%) purchase occasions for the 2635 households, 519 (4.56%) purchase occasions for organic eggs for the 292 households compared to 682 (6%) purchase occasions for the 2635 households, 40 (0.40 %) purchase occasions for vitamin-enhanced eggs for the 292 households compared to 103 (0.9%) purchase occasions for the 2635 households and lastly, 9355 (82.15 %) purchase occasions for normal eggs for the 292 households compared to 10240 (89.4%) for the 2635 households. Normal eggs and the no purchase

options (not shown in the Figure 10) represented most of the choice occasions in the sample. As for the non-normal eggs, organic eggs were the most purchased eggs; followed by omega 3 eggs, vitamin enhanced eggs and lastly, free run/range eggs for the 292 households. The entire sample consisted of 11388 observations. Figure 10 also shows that the distribution of egg purchases did not change substantially after considering households with 30 plus purchase occasion. The distribution of the free run/range and vitamin enhanced eggs in the sample were the most affected by the data manipulation. Also, it is worth noting that the smaller numbers associated with non-normal eggs maybe due to a supply constraint (availability) more than a demand constraint (consumption).

4.1.1 Data Setting for MNL and NLM with Choice as the Dependent Variable

Two different settings of the data with 292 households were used in the estimation process. In the first data setting, we ignored the quantity decision and recorded only the egg choice on each purchase occasion irrespective of the egg type. A similar approach was adopted by Erdem, Imai and Keane (2003), Chintaguntaa, Kyriazidou, Perktold (2001) and Park and Senauer (1996). This data set was used to estimate both the nested logit model and a conditional logit model reported in the next chapter with egg choice as the dependent variable. In a few instances where people did select more than one type of egg in a purchase occasion, we selected one egg type. This was done by assigning an order randomly from 1 to 5, with 1 representing normal eggs, 2 representing omega 3 eggs, 3 representing free run/range eggs, 4 representing organic eggs, and 5 representing vitamin enhanced eggs.

In an effort to assure that all egg types had an equal chance of being represented, we selected egg type 1 if a scenario was found where a household selected both the

normal egg and another type of egg. This order was reversed if the same scenario was found in the next purchase occasion choosing the non-normal egg over the normal egg. If it was the case that a household purchased two different non-normal eggs on a single purchase occasion, the egg type that appears first on the number order list was selected. The no purchase option was easily identifiable as there was a zero if no egg type was selected at all. This selection method was created in order to not bias the sample to either normal or non-normal eggs. This approach of product selection was pursued in order to fit the data for discrete choice theories which follow the random utility theory where it is assumed that individuals are utility maximizers. Chintagunta, Kyriazidou and Perktold (2001) used a similar method when they selected brands randomly when they were faced with a scenario where households purchased multiple brands at one occasion.

4.1.2 Data Setup for MNL Model with Dozen of Eggs Purchased Per Egg Type as the Dependent Variable

In the second data setting, the quantity decision was included as the dependant variable. The eggs in dozen purchased were summed up across all the 39 time periods for each egg type creating a frequency variable (number of shell eggs purchased by type). Also, for this second data set the weighted average prices for each egg type were generated for the entire 39 months. A summary of egg types purchased are shown in Table 16.

Table 16. Eggs Purchases Per Household, in dozens

EggType	Minimum	Maximum	Mean	Std. Deviation
Normal	0	246	81.39	45.26
Omega 3	0	83	2.98	11.93
Free run/range	0	29	0.39	2.61
Organic	0	101	7.11	15.36
Vitamin enhanced	0	16	0.35	1.56

Table 10 shows the highest egg type purchased per household for the entire 39 months are normal eggs, followed by organic eggs and then omega 3 eggs, free run/range eggs and lastly, vitamin enhanced eggs. This distribution pattern in egg type purchased is similar to the one shown by the choice model data setup in section 4.2.1.

This data set has an advantage over the first data set in the sense that it accounts for the multiple egg purchases that may occur in a single purchase occasion. The conditional logit model was the used in the estimation.

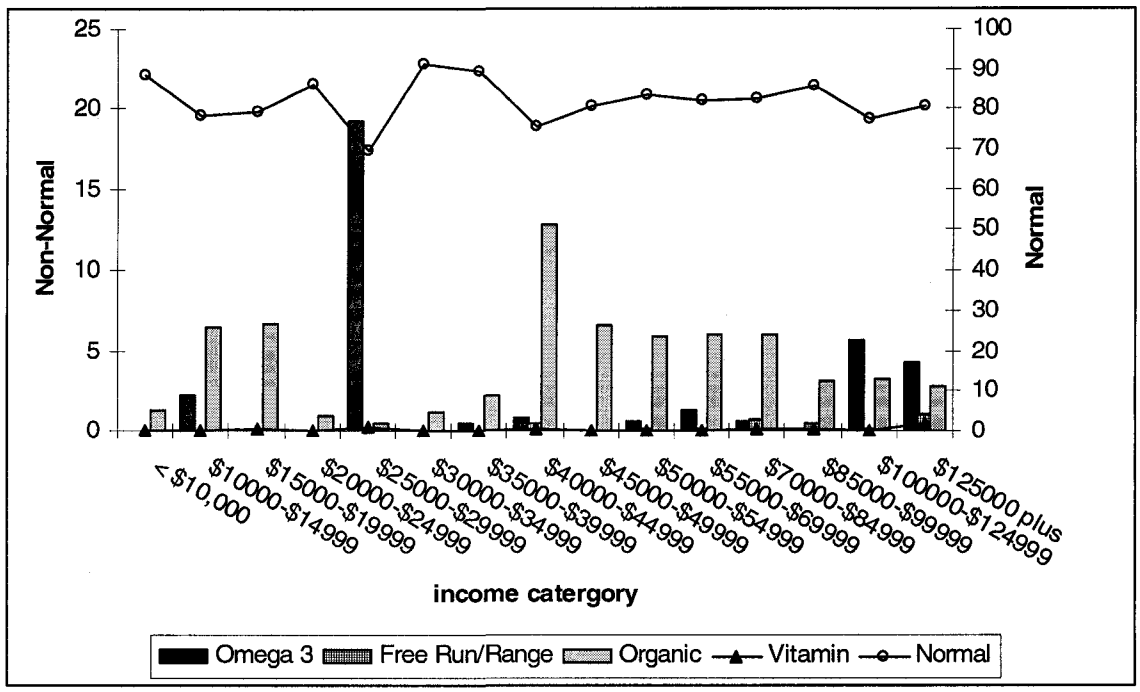
4.2. Household Demographics and Socio-economic Characteristics

As mentioned earlier, information on four demographic variables was collected and provided along with the information on prices. These demographic variables are household income, household size, age of the head of the household, presence of children and total expenditure. However, household size was removed from the final model estimated because it was found to be correlated with presence of children and total expenditure variables[26]. Thus, the variables used in this study were selected for estimation purposed based on the grounds of economic and market plausibility.

Figure 10 shows the distributions across income groups for the different egg types. The far right column shows the household income categories and the bottom row corresponds to the egg type distributions.

[26] The Pearson correlation test was used to check for correlation.

Figure 11. Frequency Distribution across Egg Types and Household Income (%)



It is clear, when comparing the percentages in Figure 11[27] that all the non-normal eggs seem to under-represented (especially with regards to free run/ range eggs and vitamin enhanced eggs) in all income groups with the exception of organic eggs. Also, the distribution of egg purchases especially for the non-normal eggs seem to be skewed towards households that fall in the high income categories. The sample has changed especially with regards to free run/range eggs and vitamin enhanced compared to the original sample of 2635 households (Appendix 2, Table 2).

Figure 12 represents the distribution of 11388 purchase occasions across the different age groups. The far right axis shows the purchasing distributions for normal eggs, and the bottom axis corresponds to the five age group categories while the left axis shows the purchasing distributions for the non-normal or differentiated eggs. The under

[27] The legend for Free run/range eggs does not show because the numbers are to low that they are hard to read.

35 age has the least representation in egg purchases compared to the other age groups. When comparing the percentages in this table, free run/range eggs and vitamin enhanced eggs are the most under represent across the different age groups. A similar pattern was observed in the entire sample of 2635 household (Appendix 2, Table 3).

Figure 12. Frequency Distribution across Different Age Groups (%)

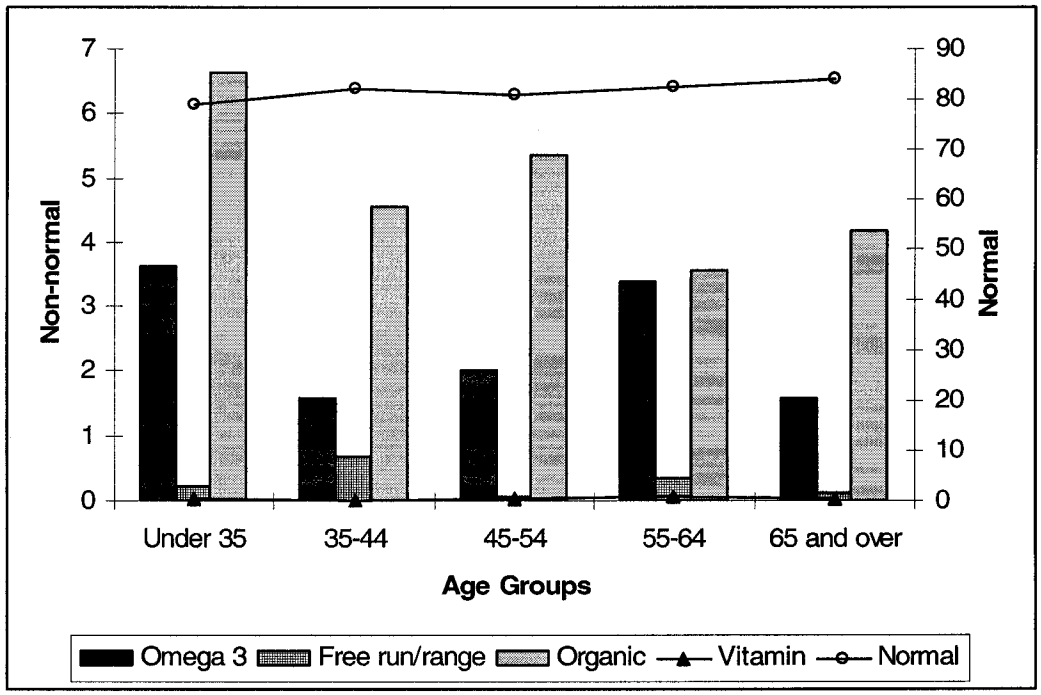
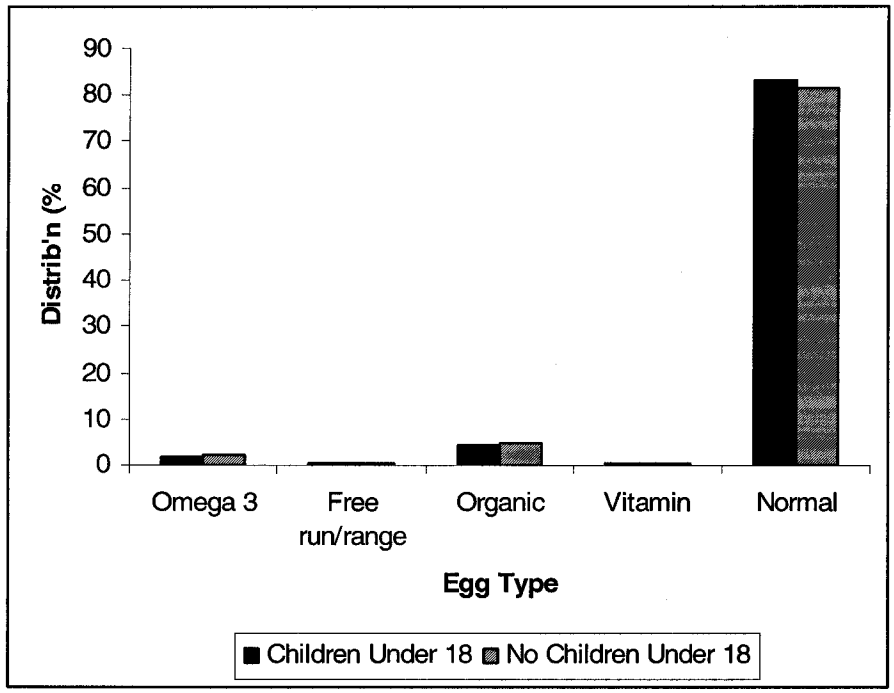


Figure 13 presents the distribution of 11388 purchase occasions across households with children under 18 years old and without children under 18 years old present. Households without children under the age of 18 purchased more eggs compared to households with children under the age of 18. When comparing the percentages in Figure 13, free run/range eggs and Vitamin enhanced eggs are under represented in the sample. A similar pattern was observed in the entire 2635 households (Appendix 2, Table 4).

Figure 13. Purchasing Frequency Distribution across Presence of Children (%)



In conclusion, based on the final data sample of 292 households and the entire sample of 2635 households it is apparent that normal eggs are the most purchased eggs with almost 90 % of the entire purchases representing normal eggs and 10 % representing the non-normal eggs. The a *priori* expectations of the effects of the descriptive statistics (Table17) and hypothesized explanatory variables on egg choice are summarized in the next section.

Table 17. Variable Definitions for Household Shell Egg Consumption Data.

	Percentage/Averages	
	2635 households	**292 households**
HOUSEHOLD INCOME (HINC)		
> $10,000	1.23	0.68
$10000-$14999	2.42	2.74
$15000-$19999	2.51	2.74
$20000-$24999	5.29	5.82
$25000-$29999	4.11	4.11
$30000-$34999	6.32	5.14
$35000-$39999	5.05	5.14
$40000-$44999	5.80	5.14
$45000-$49999	5.27	2.4
$50000-$54999	7.16	7.53
$55000-$69999	16.61	17.47
$70000-$84999	13.32	13.01
$85000-$99999	9.54	10.27
$100000-$124999	8.38	10.27
$125000 and <	6.99	7.53
Average	**$65,273.17**	**$67,554.34**
HEAD AGE (AGE)		
Under 35	7.18	4.11
35-44	25.80	24.32
45-54	28.83	27.4
55-64	20.20	21.23
65 and over	17.99	22.95
Average (median)	***50 years (49.5 years)***	***52 years (49.5years)***
PRESENCE OF CHILDREN (POC)		
Children Under 18	32.87	36.9863
No Children Under 18	67.13	63.0137
TOTAL EXPENDITURE (TE)		
Average	**$2,060.08**	**$3,390.68**

Table 18. Alberta census data (2001)

Variable	Percentage of population		
	Alberta	*Ontario*	*Canada*
HOUSEHOLD INCOME $			
Under 10,000	4.8	5.2	6.4
10,000-19,999	10.2	10.7	12.7
20,000-29,999	10.8	10.3	11.9
30,000-39,999	10.8	10.4	11.5
40,000-49,999	10.5	9.9	10.6
50,000-59,999	9.6	9	9.3
60,000-69,999	8.9	8.5	8.2
70,000-79,999	7.4	7.2	6.6
80,000-89,999	6	6	5.3
90,000-99,000	4.7	4.9	4.1
100,000over	16.2	18.1	13.5
Average	***$64,199.00***	***$66,836***	***$58,360***
AGE			
Under 25	35.9	32.6	32.4
25-44	32.1	30.9	30.3
45-64	22.4	23.6	24.3
65 over	9.7	13	15.2
Median	***35 years***	***37.2 years***	***37.6 years***
ALL FAMILIES [28]			
Without children at home	36.69	39	41
With children at home	63.31	61	59

Statistics Canada (2006)

By comparing Table 17 to Table 18, it appears that the sample is a fair representation of the Alberta and Canadian population with regard to presence of children. With regards to age, the lower age groups are underrepresented in the data (for the sample with 2635 households and the 292 households) as compared to the Alberta census and the national census as a whole. The opposite holds for the higher age groups in the sample where they have been over represented as compared to the Alberta and Canadian national census data. Also, the lower income groups are under represented in the sample as compared to the Canada census data.

[28] The variable all families is made up of married couples, common-law couples, single parents with or with out children and non-family persons with or without children

The average income in the sample of the 292 households is higher compared to the sample of 2635 households, the Alberta census profile and the Canadian census profile. The difference in the average income is more apparent when comparing the Canadian average household income and the sample of the 292 households. Also, there is clearly a major difference between the median ages from the sample of 292 households and the Alberta, Ontario and Canadian census profile. This difference may be due to the fact that in the Alberta, Ontario and Canadian census profiles all ages were considered while in the sample of 292 households only the age of the head of the household was considered. Clearly, a larger sample would be preferred (by comparing Table 17 to Table 18), since it appears that the sample may not be a fair representation of the Alberta and Canadian population in almost all the demographic categories. Thus, one can conclude that the responses from this sample may not be a good prediction of how the entire population will behave.

4.3. Hypotheses

4.3.1. Income[29]

Functional and specialty foods are often more expensive than standard counterparts (normal eggs) in terms of shelf price (Tables 4, 5 and 11). This possibly reflects higher production costs and also discriminatory pricing due to the processors perceptions of less elastic demand. Thus, higher prices suggest that income may be an important factor in the demand for functional foods. However, it is worth noting that eggs are relatively inexpensive and thus income could play a minor role in egg selection. Thus, no conclusive hypothesis can be reached about how income could or may impact egg

[29] As an aside, income and total expenditure were scaled down to thousands solely for estimation purposes.

choice. Thus there is a weak expectation of a positive income effect with regards to the purchase of differentiated egg types.

4.3.2 Age

It is assumed that the older people become the more health and food safety conscious they are. Oliveira (2003) states that even with healthy eating habits, physical activity and other healthy ways of living there are certain health conditions that come with aging. Increases in incidences of medical conditions such as arthritis, high blood pressure, and high cholesterol levels rise as people age. Oliveira (2003) states that since there is a movement towards being more responsible personally for health, there will be increased interest in functional foods or herbal remedies that will address these issues. Similarly, a study by Lin (1995) showed that men, consumers with no children, are young, and those with some college education are less concerned about food safety than other demographic groups. Given these observations, one could argue that older people have greater health and food safety concerns. Thus, one would expect that older people would prefer eggs that have health and food safety claims attached to them such as vitamin enhanced or omega-3 respectively. However, different products may elicit different reactions from different age groups. Since the previous Canadian studies did not use eggs to explore consumer concerns with regards to food safety and health we cannot unequivocally support the hypothesis that older people prefer the above egg types.

This conclusion is supported by Cunningham's (2004) study that found that among heavy purchasers of organic food products, people in the 25-34 age group are more likely to purchase organic foods than people in the over 55 age group. Cunningham (2004) also found that among light purchasers of organic foods, people in the 18-34 age

groups are more likely to purchase organic foods than people over the age of 55. Thus, it would be expected that younger people would prefer organic eggs. Cunningham also notes that factors relating to health and concern over what people eat are driving factors for the increased demand in organic foods. It is difficult to set forth an argument of the impact age will have on the demand for free run/range eggs since these eggs only have animal welfare claims and have no additional health benefits compared to normal eggs. However, using the argument that consumers view free-range and organic food products as similar products (Harper and Makatouni, 2002), one could argue that older people are less likely to purchase free run/range eggs.

4.3.3. Presence of children

It is hypothesized that households with children under 18 may be more health conscious and food safety conscious thus may be expected to purchase either vitamin enhanced eggs, omega-3 eggs or organic eggs. That is to say, it would be expected that consumers with children would buy vitamin enhanced eggs or organic eggs or omega 3 eggs because they care about giving their children foods with fewer pesticides, more health benefits and they care about the environmental quality that their children will experience in the future. This hypothesis is supported in Loureiro, McCluskey and Mittelhammer's (2002) study on willingness to pay for eco-labelled apples in Oregon, Portland. This study found the presence of children under 18 years old and the main purchaser being female had a positive effect on willingness to pay for eco-labelled apples. Loureiro et al. (2002) state that this is expected, since female respondents with small children may be concerned about the use of pesticides and therefore are willing to pay a premium to avoid them. Also, Hartman (1999) identifies three specific triggers for

purchasing organic food: Children, allergies and preference for a healthy lifestyle. It is difficult to set forth an argument of the impact of presence of children on the demand for free run/range eggs since these eggs only have an animal welfare claims and have no additional health benefits compared to normal eggs. Our hypothesis is that households with children under the age of 18 at home are more likely to purchase omega 3, organic and vitamin enhanced eggs.

4.3.4. Total food expenditure.

Reynolds-Zayak (2004) notes that in 2001 Canadian households spent an average of $124 per week in either stores or restaurants. Also, in 2001, Statistics Canada noticed that Canadian were shifting their food purchasing patterns in favour of more prepared, value-added and gourmet foods (Reynolds-Zayak 2004). Reynolds-Zayak (2004) also notes that the proportion of food budget spent on each food category was similar in every income group. In total Canadians spent a weekly average of $13 on dairy and eggs. Thus, it hypothesized that total food expenditure has a positive effect on the purchase of eggs as they are easy to prepare and have many health attributes that are convenient for the fast paced life that many Canadians live today.

4.4. Conclusion

In this section the data that is going to be used for the analysis is presented. Also, the hypothesis for each of the variables and the rationale for the hypotheses are also presented.

Chapter 5 Empirical Results and Discussion

5.0. Introduction

In this chapter we present the results and discuss their implications for the three different models. The First model is the nested logit model as shown in Figure 8 which is estimated using FIML estimation and has choice as the dependant variable; the second model is the conditional logit model with choice as the dependant variable and the third model is a conditional logit model with frequency (i.e. eggs per dozen purchased for the entire time period per household for the entire 39 months) as the dependant variable.

5.1. Results

5.1.1 Nested Logit Model with Choice as the Dependent Variable

Shell egg choice is modelled as a nested logit model based on the socioeconomic variables and FIML estimation procedure is employed. Because FIML is used in the estimation process, the results from the nested logit model represent the probability of purchase among the households who have purchased the various egg types/alternatives. Thus, the equation of interest is the utility from choosing egg type k by household n given the decision on whether to purchase eggs, i ,has been made.

$$V_{kni} = ASCN + \beta' PRC_{jn} + \beta' HSZ_n + \beta' HAGE_n + \beta' POC_n + \beta' TE_n + \beta' IV \quad \text{.....(5.1)}$$

where IV is equal to the inclusive value as determined by equation (3.14) and all the other independent variables are as defined in Table 8 and Table 9 in Chapter 3.

The model was run using NLOGIT, Version 3.0.1(Greene, 2002) and the results from the FIML estimation of the nested conditional logit are given in Table 19.

Table 19. The Estimation Results for the Nested Logit Model

Variables	Parameters	t-values
PRICE	-2.1189**	-26.1
Normal Eggs		
ASC	4.7464**	15.008
Household Income	-0.0020*	-1.849
Presence of children	0.1184	1.165
Age	0.0067**	1.962
Total Expenditure	0.1868**	5.115
Omega 3 Eggs		
ASC	2.9137**	5.378
Household Income	0.0030	1.478
Presence of children	0.3488*	1.693
Age	-0.0010	-0.151
Total Expenditure	0.0903	1.489
Free Run/Range Eggs		
ASC	-2.2328*	-1.929
Household Income	0.0115**	2.505
Presence of children	1.5417**	3.478
Age	-0.0351**	-2.423
Total Expenditure	0.4780**	5.169
Organic Eggs		
ASC	3.2501**	7.031
Household Income	-0.0082**	-4.621
Presence of children	0.8358**	5.193
Age	-0.0169**	-3.293
Total Expenditure	0.4397**	9.705
Vitamin Enhanced Eggs		
ASC	-5.3043**	-3.852
Household Income	0.0198**	4.768
Presence of children	-1.1470**	-2.34
Age	0.1103**	4.887
Total Expenditure	0.2850**	2.671
Inclusive Value for purchase option	0.8761**	8.742
Log-likelihood		-6963.67
Adjusted Pseudo R2		0.072
Number of observations		68328
Restricted (Slopes=0) Log-L		-7500.45
Log-likelihood		-6963.67

** $p < .05$ * $p < .10$

One measure of goodness-of-fit is the use of the pseudo R-squared[30] . This is a measure of the predictive capability of the model. The pseudo R-squared value of the final model is 0.072. While a higher goodness-of fit would be preferred, this value is typical when using large pooled data sets (Medina and Ward, 1999). Additionally, to determine whether a model is statistically significant we use the *LL ratio-test*[31] to compare the LL function of the estimated model to that of the base model (i.e. a model with only the ASCs) at $\alpha < 0.05$. The χ^2 value from the LL ratio-test is 1073.56. Comparing this result to a $\chi^2_{(21)df}$ of 32.67 shows that the estimated model performs better than the base model in predicting peoples' choices since the statistic obtained from the LL ratio-test is higher than the critical chi–squared statistic.

The number of observations used in the final estimation is 11388 which is equivalent to purchases for 292 households in Alberta. Longitudinal data used consisted of time series observations on each of the several cross-sectional units. "Cross-sectional and time series components in the model residues should not present a problem given that household differences were captured with demographics" (Medina and Ward, 1999, p 203). The inclusion of additional demographics was limited by the information provided from ACNielsen.

The ASCs are positive and significant for normal eggs, omega 3 eggs and organic eggs at the 5 % level. Also, the ASC is negative and significant with regards to vitamin enhanced eggs at the 5 % level and negative and for free run/range eggs at the 10

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[30] Following Hensher, Rose and Greene (2005), the calculation of the R^2 is $R^2 = 1 - \frac{LL_{Estimated-model}}{LL_{Base-model}}$

[31] LL ratio-test = -2($LL_{\text{largest model}}$-$LL_{\text{smallest model}}$) ~$\chi^2_{\text{(difference in the number of parameters estimated between the two models)}}$. This model is referred to as the LL ratio-test because the difference between the log of the two values is mathematically equivalent to the log of the ratio of the two values (Hensher, Rose and Greene, 2005).

% level. The positive ASCs imply that that there is some positive utility associated with purchasing normal, organic and omega 3 eggs, all other things held constant. The negative ASC implies that there is some disutility associated with purchasing vitamin enhanced eggs, all other things held constant. The alternative specific constants, however, cannot be interpreted separately from the other estimated parameters of the model.

The price coefficient is negative and significant, indicating that increasing price decreases the probability of a household purchasing any egg type. This is as expected since an increase in the price of any egg type should reduce the probability of that type being chosen. This result corresponds with economic theory.

The coefficient on the income variable is positive and significant for free run/range and vitamin enhanced eggs and positive but not significant for omega 3 eggs. The income variable is negative and significant for normal eggs and organic eggs. This means that as household incomes increase, so does the probability of purchasing free run/range eggs and vitamin enhanced eggs while the probability of purchasing organic and normal eggs decreases relative to the no purchase option.

The coefficient on the presence of children is positive and significant for omega 3 eggs, free run/range eggs and organic eggs and positive and not significant for normal eggs. Also, presence of children variable is negative and significant for vitamin enhanced eggs. These results suggest that the presence of children in a household will result in an increase in the probability of purchasing omega 3 eggs, free run/range and organic eggs while the presence of children corresponds to a decrease in the probability of purchasing vitamin enhanced eggs.

The coefficient on age is positive and significant with regards to vitamin enhanced egg and normal eggs. The coefficient on age is negative and significant with regards to free run/range eggs and organic eggs and is negative and not significant with regards to omega 3 eggs. This result suggests that as the age of the head of the household increases (person assumed to be making most of the food purchases) the probability of purchasing organic and free run/range eggs decreases; also, as age increases the probability of purchasing vitamin enhanced eggs increases.

The coefficient on total food expenditure is positive and significant for all egg types with the exception of omega 3 eggs. This result suggests that an increase in total food expenditures will increase the probability of purchasing any egg type.

The estimated coefficient of the inclusive value (IV) represents the dissimilarity factor at the purchase option stage/branch in the nest. A Wald test was carried out to find if the inclusive value is significant. The test-statistic is calculated by dividing IV by its associated standard error and comparing the resulting value to some critical value[32] (Hensher, Rose and Greene, 2005). If the dissimilarity (IV) factor is statistically equal to one, it means that that the choice alternatives are completely dependent within the choice set at the decision level. Thus, if the IV of a branch is found to be equal to one, that respective branch should collapse into a single branch, which is equivalent to a multinomial/conditional logit model. If the IV parameter equals zero, choice alternatives are not significant. Hensher, Rose and Greene (2005) note that by carrying out this test

[32] Usually the critical value is ± 1.96, representing a 95 percent confidence level. Hensher, Rose and Greene (2005) note that this test is exactly the same as the one sample t-test.

one would reach a similar conclusion as though they had carried out an IIA on a conditional/multinomial logit model.

For the case of this thesis, the IV parameter is statistically different from zero, thus it is imperative that we under take another test to determine whether the variable is statistically different from one. Comparing the test-statistic of -1.24 to the critical value of ± 1.96 , we cannot reject the hypothesis that the IV parameter for the purchase option is statistically equal to one. Having normalized the IV parameter for the no purchase branch to one, we now find that the IV parameter for the purchase branch is also equal to one, meaning that the two branches should collapse into a single branch which is equivalent to a multinomial/conditional logit model. Thus, for this thesis, our preference should be to use the simpler multinomial/conditional logit model rather than a nested logit model.

5.1.2. Conditional Logit Model with Choice as the Dependant Variable

The coefficients of the model described in equations 3.6 to 3.11 were estimated using NLOGIT, version 3.0.1(Greene, 2002) [33] and the results are presented in Table 20. In the conditional logit model postulated, egg purchase by type is assumed to be dependent on a set of socio-economic variables and prices of the different egg types. Egg types were grouped into (1) "neither" option, (2) omega-3 eggs, (3) free run/range eggs, (4) organic eggs, (5) vitamin-enhanced eggs, and (6) normal. The "neither option" reflects the decision that the individual didn't purchase any egg type. This notion is supported by the fact that information on the total expenditure on all composite goods for the time period being studied is also available. The estimated coefficients β_j for all $j(j = 1,.....J)$, after

normalizing the "neither alternative" $j = 0$, measure the effect of the explanatory variables in the indirect utility function on the likelihood of choosing egg type i relative to the "neither option". Estimates from the equation (3.6-3.11) are reported for normal eggs, omega-3 eggs, free run/range eggs, organic eggs and vitamin enhanced eggs in Table 13 while the neither option is not shown since the probability for the j^{th} option is known once j-1 of the egg options are estimated. Estimates with a negative sign imply the preference for the "no purchase" option while estimates with a positive sign imply the preference for a respective type of egg.

Table 20. Conditional Logit Regression Estimates

Variable	Parameter	t-values
PRICE	-2.087**	-27.300
Normal Eggs		
ASC	4.527**	19.896
Household Income	-0.002*	-1.870
Presence of children	0.101	1.144
Age	0.006**	2.033
Total Expenditure	0.161**	6.623
Omega 3 Eggs		
ASC	2.659**	5.505
Household Income	0.003*	1.700
Presence of children	0.336*	1.683
Age	-0.002	-0.269
Total Expenditure	0.065	1.201
Free Run/Range Eggs		
ASC	-2.459**	-2.167
Household Income	0.012**	2.587
Presence of children	1.523**	3.461
Age	-0.036**	-2.493
Total Expenditure	0.452**	5.125
Organic Eggs		
ASC	2.998**	7.623
Household Income	-0.008**	-4.712
Presence of children	0.821**	5.383
Age	-0.018**	-3.625
Total Expenditure	0.414**	11.505
Vitamin Enhanced Eggs		
ASC	-5.535**	-4.078
Household Income	0.020**	4.880
Presence of children	-1.157**	-2.376
Age	0.109**	4.864
Total Expenditure	0.259**	2.517
Log-likelihood		-6964.13
Adjusted Pseudo R^2		0.067
Number of observations		11388
Restricted (Slopes=0) Log-L		-7500.45
χ^2 (20)		31.41

** $p < .05$ * $p < .10$

The pseudo R-squared value of the final model is 0.067. Additionally, to determine whether a model is statistically significant we use the Likelihood ratio-test to compare the Log Likelihood function of the estimated model to that of the base model (i.e. a model with only the ASCs) at $\alpha < 0.05$. The χ^2 value from the LL ratio-test is 1072. Comparing this result to a $\chi^2_{(20)df}$ of 31.41 shows that the estimated model performs better than the base model in predicting peoples choices since the statistic obtained from the LL ratio-test is higher than the critical chi–squared statistic. The number of observations used in the final estimation is 11388 which is equivalent to the purchases from 292 households in Alberta.

The ASCs are positive and significant for normal eggs, omega 3 eggs and organic eggs at the 5 % level. Also, the ASC is negative and significant with regards to vitamin enhanced eggs and free run/range at the 5 % level. The positive ASCs imply that that there is some positive utility associated with purchasing normal, organic and omega 3 eggs, all other things held constant. The negative ASC implies that there is some disutility associated with purchasing vitamin enhanced eggs, all other things held constant. The alternative specific constants, however, cannot be interpreted separately from the other estimated parameters of the model.

The price coefficient is negative and significant, indicating that increasing price decreases the probability of a household purchasing any egg type. This is as expected since an increase in the price of any egg type should reduce the probability of that type being chosen.

The coefficient on the income variable is positive and significant for free run/range and vitamin enhanced eggs and positive and significant for omega 3 eggs at the

10% level. The income variable is negative and significant for normal eggs at the 10% level and for organic eggs at the 5 %. This means that as household incomes increases, so does the probability of purchasing free run/range eggs and vitamin enhanced eggs while the probability of purchasing organic and normal eggs decreases relative to the no purchase option.

The coefficient on the presence of children is positive and significant for omega 3 eggs at the 10%, and for free run/range eggs and organic eggs at the 5 %. As for normal egg the coefficient on income is positive but not significant for normal eggs. Also, presence of children variable is negative and significant for and vitamin enhanced eggs. These results suggest that the presence of children in a household will result in an increase in the probability of purchasing omega 3 eggs, free run/range and organic eggs while the presence of children corresponds to a decrease in the probability of purchasing vitamin enhanced eggs.

The coefficient on age is positive and significant with regards to vitamin enhanced egg and normal eggs. The coefficient on age is negative and significant with regards to free run/range eggs and organic eggs and is negative and not significant with regards to omega 3 eggs. This result suggests that as the age of the head of the household increases (person assumed to be making most of the food purchases) the probability of purchasing organic and free run/range eggs decreases; also, as age increases the probability of purchasing vitamin enhanced eggs increases.

The coefficient on total food expenditure is positive and significant for all egg types with the exception of omega 3 eggs. This result suggests that an increase in total food expenditures will increase the probability of purchasing any egg type.

The results obtained from conditional logit model are almost similar to those obtained from the nested logit model. The coefficients from the conditional logit model are slightly smaller and also household income is positive and significant at the 10 % in the conditional logit model while in the nested it was not significant. Despite these slight differences, the signs on the on all the coefficients remained the same a factor which is when estimating these kinds of models

5.1.3 Price Elasticities of Probabilities

The price elasticities of probabilities are calculated for the estimates from the conditional logit model. These are analogous to price elasticities but relate to the choice probability response to price changes, as opposed to quantity consumed (Park and Senauer, 1996). Specifically, the own – price elasticities of choice probability indicate the percent change in the probability of a choice with respect to a one percent change in that price (Park and Senauer, 1996; Hensher, Rose and Greene, 2005). Previous research (Hassan and Johnson, 1976; Kulshreshtha and Ng, 1977; Johnson and Safyurtlu, 1984; Chyc and Goddard, 1992; Hailu and Goddard, 2004) shows that the estimated own-price elasticities for food products are usually inelastic, with many lying between 0 and -0.5. However, the estimated own-price elasticities of probability (Table 21) indicate that all the non-normal egg types are highly elastic. The major reason is that these alternatives are sufficiently similar to be very close or nearly perfect substitutes for one another so that households are very sensitive to price differences.

Table 21. The Estimated Own Elasticities and Cross Elasticities of the Probabilities of Choice with Respect to Prices

	Egg type				
	Normal	Omega 3	Free Run/Range	Organic	Vitamin
Normal	-0.602	0.108	0.12	0.215	0.015
Omega 3	2.702	-5.116	0.12	0.215	0.015
Free Run/Range	2.702	0.108	-4.753	0.215	0.015
Organic	2.702	0.108	0.12	-5.227	0.015
Vitamin	2.702	0.108	0.12	0.215	-4.855

Organic eggs have the largest own-price responsiveness with -5.227, while normal eggs have the smallest with -0.602. Free run/range, omega 3 and vitamin enhanced eggs have larger price elasticities than the normal eggs. Note that the cross-elasticities are the same across the different egg types due to the fact that the choice alternatives outside a respective egg type are independent of each other as discussed previously (recall the IIA assumption).

5.2. Conditional Logit Model with Frequency as the Dependant Variable

The dependant variable frequency is equal to the total number of eggs purchased BY dozen for each egg type for the entire 39 months. As mentioned in chapter 3, by using frequencies, one can account for the multiple egg purchases by a household at one purchase occasion. In the frequency model the "neither option" is omitted because it does not represent an egg type. Also, given that we selected households that purchased eggs over 30 times out of the 39 time periods, omitting the "neither option" should not be a cause of great concern.

The coefficients of the model described in equations 3.6 to 3.11 were estimated using NLOGIT, version 3.0.1(Greene, 2002) and the results are presented in Table 22. In the conditional logit model postulated, egg purchase by type is assumed to be dependent on a set of socio-economic variables and price of the different egg types. Egg types were grouped into (1) omega-3 eggs, (2) free run/range eggs, (3) organic eggs, (4) vitamin-enhanced eggs, and (5) normal. The estimated coefficients β_j for all $j(j = 1,.....J)$, after normalizing the "normal alternative" $j = 0$, measure the effect of the explanatory variables in the indirect utility function on the likelihood of choosing egg type i relative to the "normal option". Estimates from the equation (3.6-3.11) are reported for omega-3 eggs, free run/range eggs, organic eggs and vitamin enhanced eggs in table 22 while the normal option is not shown since the probability for the j^{th} option is known once j-1 of the egg options are estimated. Estimates with a negative sign imply the preference for the "no purchase" option while estimates with a positive sign imply the preference for a respective type of egg.

Table 22. Conditional Logit Regression Estimates for Frequency Model

Variable	Parameter	t-values
PRICE	-2.72749**	-51.014
Omega 3 Eggs		
ASC	-1.6583**	-5.082
Household Income	0.0062**	4.156
Presence of children	-0.6097**	-3.713
Age	0.0029	0.574
Total Expenditure	-0.1402**	-3.037
Free Run/Range Eggs		
ASC	-3.94264**	-5.931
Household Income	0.0172**	5.131
Presence of children	-1.4281**	-4.175
Age	-0.0536**	-4.678
Total Expenditure	0.3908**	5.579
Organic Eggs		
ASC	-0.19645	-0.962
Household Income	-0.0096**	-9.027
Presence of children	-0.6510**	-6.876
Age	-0.0219**	-7.526
Total Expenditure	0.3578**	17.057
Vitamin Enhanced Eggs		
ASC	-12.7529**	-10.092
Household Income	0.0282**	8.505
Presence of children	1.775**	4.483
Age	0.1126**	6.337
Total Expenditure	-0.1511*	-1.709
Log-likelihood		-6341.72
Adjusted Pseudo R^2		0.2414
Number of observations		292
Restricted (Slopes=0) Log-L		-8359.20
$\chi^2(15)$		25.00

** $p < .05$ * $p < .10$

The pseudo R-squared value of the final model is 0.2414 (24.14%). Additionally, to determine whether a model is statistically significant we use the Log-likelihood ratio-test to compare the LL function of the estimated model to that of the base model (i.e. a model

with only the ASCs) at $\alpha < 0.05$. The χ^2 value from the LL ratio-test is 4034. Comparing this result to a $\chi^2_{(15)df}$ of 25.00 shows that the estimated model performs better than the base model in predicting peoples choices since the statistic obtained from the LL ratio-test is higher than the critical chi–squared statistic. The number of observations used in the final estimation is 292 which is equivalent to 292 households in Alberta.

The ASCs are negative and significant for omega 3 eggs, free run/range eggs and vitamin enhanced eggs and negative and not significant for organic eggs at the 5 % level. The negative ASC implies that there is some disutility associated with purchasing omega 3 eggs, free run/range eggs and vitamin enhanced eggs relative to normal eggs, all other things held constant. The alternative specific constants, however, cannot be interpreted separately from the other estimated parameters of the model. The price coefficient is negative and significant, indicating that increasing price decreases the probability of a household purchasing any egg type. This is as expected since an increase in the price of any egg type should reduce the probability of that type being chosen. This result conforms to economic theory.

The coefficient on the income variable is positive and significant for omega 3 eggs, free run/range and vitamin enhanced eggs and negative and significant organic eggs. This means that as household incomes increases, so does the probability of purchasing omega 3 eggs, free run/range eggs and vitamin enhanced eggs relative to the normal eggs while the probability of purchasing organic decreases relative to the normal eggs.

The coefficient on the presence of children is positive and significant for vitamin enhanced eggs relative to the normal eggs, and negative and not significant for omega 3 eggs, free run/range eggs and organic eggs relative to normal eggs. These results suggest that the presence of children in a household will result in an increase in the probability of purchasing vitamin enhanced eggs relative to the normal eggs while presence of children in a household will decrease the probability of purchasing omega 3 eggs, free run/range eggs and organic eggs relative to normal eggs.

The coefficient on age is positive and significant with regards to vitamin enhanced egg and positive and not significant with regard to omega 3 eggs. The coefficient on age is negative and significant with regards to free run/range eggs and organic eggs. This result suggests that as the age of the head of the household increases (person assumed to be making most of the food purchases) the probability of purchasing organic and free run/range eggs decreases relative to the normal option. Similarly, as age increases the probability of purchasing vitamin enhanced eggs increases relative to normal eggs.

The coefficient on total food expenditure is positive and significant for free run/range eggs and organic eggs and negative and significant for omega 3 eggs and vitamin enhanced eggs. This result suggests that as total food expenditures increases, the probability of purchasing free run/range and organic eggs increases relative to normal eggs. Similarly, as total food expenditure increases, the probability of purchasing omega 3 and vitamin enhanced eggs decreases relative to normal eggs.

5.2.1 Price Elasticities of Probabilities for Frequency Model

The estimated own-price elasticities of choice probability (Table 23) show that all the non-normal egg types are highly elastic. Organic eggs have the highest own-price response with -6.871, while normal eggs have the lowest price response with -0.308. Note that the cross elasticities in each column in Table 23 are the same across the different egg types and are asymmetric due to the IIA property in a multinomial logit model. For example, a one percent increase in the price of normal eggs will increase the probability of choosing omega 3 eggs as well as the other types of eggs by 3.959 percent, while a one percent increase in the price of omega 3 eggs will increase the probability of purchasing normal eggs as well as the other egg types by 0.109 percent. Thus, one can clearly see that the IIA property is a considerable restriction to place on household consumer behaviour.

Table 23. The Estimated Own Elasticities and Cross Elasticities of the Choice Probabilities with Respect to Prices based on the Frequency MNL Model

	Egg type				
	Normal	Omega 3	Free Run/Range	Organic	Vitamin
Normal	-0.308	0.109	0.016	0.229	0.015
Omega 3	3.959	-6.737	0.016	0.229	0.015
Free Run/Range	3.959	0.109	-6.237	0.229	0.015
Organic	3.959	0.109	0.016	-6.871	0.015
Vitamin	3.959	0.109	0.016	0.229	-6.361

5.2.2 Assessing the Economic Value of the Value Added Egg Products Using Only the Estimates from the Conditional Logit and Frequency Model

Two types of welfare measure exist: welfare measures derived from the Hicksian demand curve that is to say, the compensating and equivalent variation and consumer surplus which is derived from the Marshallian demand curve. In this thesis, the compensating variation (CV) will be used to calculate the welfare associated with each egg type. The CV can be defined as the amount of money that has to be taken from a household in the new state (in our case the new state will represent any of the non-normal eggs) in order to keep the household at the initial state utility level (normal eggs). This implies that:

$$U^0(m, p^0, x_j^0) = U^1(m - CV, p^1, x_j^1) \tag{5.2}$$

where U^0 denotes the initial utility level and U^1 denotes the utility after a change from level of quality x_j^0 to x_j^1. By assuming that the price function is linear and that the marginal utility of money is constant as shown below:

$$U^0 = \gamma(m - p^0) + \beta x_j^0 = \gamma(m - CV - p^1) + \beta x_j^1 = U^1 \tag{5.3}$$

where γ is the price coefficient representing marginal utility of income or the marginal disutility of price. Assuming linearity in price implies that income cancels out and hence there is no income effect. Since income has cancelled out, the price coefficient implicitly denotes the marginal disutility of price. Thus,

$$U^0 = -\gamma p^0 + \beta x_j^0 = -\gamma(p^1 + CV) + \beta x_j^1 = U^1 \tag{5.4}$$

Thus, the change in welfare then becomes:

$$\Delta CV = \frac{\left(\partial U / \partial x_j\right)\Delta x_j}{\partial U / \partial(p)} = \frac{(U^1 - U^0)}{\gamma} = \frac{\Delta \beta x_j}{\gamma} \tag{5.5}$$

In chapter 3 we described our utility as follows:

$$V_{in} = ASCN + \beta' PRC_{jn} + \beta' HSZ_n + \beta' HAGE_n + \beta' POC_n + \beta' TE_n \tag{5.6}$$

Researchers are normally interested in any changes in welfare due to change in the qualitative attributes while holding prices constant. Thus the CV or welfare measure than becomes the difference between the non-normal eggs (new state) and the normal eggs (old state) divided by the negative of the price coefficient (Louviere et al. 2000).

$$\Delta CV = \frac{\left(\partial U / \partial x_j\right)\Delta x_j}{\partial U / \partial(p)} = \frac{(V^1 - V^0)}{-\beta_{price}} \tag{5.7}$$

where this welfare measure indicates the average WTP for a quality improvement in the good in a "state of the world", in our case the "state of the world" is the case where there are only normal eggs.

This method of calculating the willingness to pay estimates is deemed appropriate based on the assumption made that each of the egg types possesses a unique mix of quality attributes that may be identified by the consumer through the label. Free run and free-range egg were characterised by increasing animal welfare in production relative to normal eggs (space, access to out-door areas, etc.). The organic production method employed in the production of organic eggs may be regarded as a specific mix of quality attributes, such as animal welfare, environmental and health (food safety and environmental claims being the major attributes for organic eggs) relative to normal eggs.

omega-3 eggs and vitamin enhanced eggs have, as attributes, health claims while the normal egg is viewed as the base case with no particular claim attached to it.

Using estimates from Table 20 for the conditional logit with choice as the dependent variable and estimates from Table 22 for the conditional logit model with frequency as the dependant variable, welfare changes were calculated for each egg type evaluating how the welfare changes as income, age of the head of the household and total expenditure change holding prices constant. Table 24 and Table 25 show how the estimated welfare changes with respect to each egg type as household income changes.

Table 24. Welfare Changes with Respect to Income for the Choice Model

	Welfare Changes $			
Income	omega 3	free run/range	organic	vitamin
10000	-0.87	-3.28	-0.76	-4.72
20000	-0.85	-3.21	-0.79	-4.61
30000	-0.82	-3.15	-0.82	-4.51
40000	-0.80	-3.08	-0.85	-4.40

Table 25. Welfare Changes with Respect to Income for the Frequency Model

	Welfare Changes $			
Income	Omega 3	Free run/range	Organic	Vitamin
10000	-0.59	-1.38	-0.11	-4.57
20000	-0.56	-1.32	-0.14	-4.47
30000	-0.54	-1.26	-0.18	-4.37
40000	-0.52	-1.19	-0.21	-4.26

Table 24 and Table 25 show that in general household's welfare is not increased with the introduction of non-normal eggs. Also, the welfare changes from the choice model are higher compared to those associated with the frequency model. This difference in the result may be due to the fact that in the choice model the "no purchase" is included as an alternative while in the frequency model the "no purchase" option is not considered as an alternative. Despite the difference in the magnitude of the welfare results associated with

choice model and the frequency model, the income variable shows a similar trend for household's willingness to pay for the differentiated egg types.

Comparing the results from Table 24 and Table 25, the welfare loss was highest for vitamin enhanced eggs and smallest for organic eggs with respect to income. The welfare loss decreased as income increased for omega 3, free run/range and vitamin enhanced eggs while the welfare loss increased as income increased with respect to organic eggs. These results suggest that households appear to be willing to trade-off normal eggs for vitamin enhanced, free run/range and omega 3 eggs as income increases while they are not willing to trade-off normal eggs for organic eggs as income increases.

Table 26. Welfare Changes with Respect to Age for the Choice Model

	Welfare Changes $		
Age	Free run/range	Organic	Vitamin
20	-3.75	-0.96	-3.83
30	-3.95	-1.08	-3.34
40	-4.15	-1.19	-2.85
50	-4.35	-1.31	-2.35

Table 27. Welfare Changes with Respect to Age for the Frequency Model

	Welfare Changes $		
Age	Free run/range	Organic	Vitamin
20	-1.84	-0.23	-3.85
30	-2.04	-0.31	-3.44
40	-2.23	-0.39	-3.02
50	-2.43	-0.47	-2.61

Table 26 and Table 27 show that households experienced a loss in welfare with respect to age. Once again, the welfare changes from the choice model are higher as compared to those associated with the frequency model. Like the welfare impacts associated with income for both models, this difference in the result may be due to the fact that in the

choice model the "no purchase" is included as an alternative while in the frequency model the "no purchase" option was not considered as an alternative. Despite the difference in the magnitude of the welfare results associated with choice model and the frequency model, the age of the head of the household variable shows a similar trend on household's willingness to pay for the differentiated egg types.

The welfare loss was highest for vitamin enhanced eggs and smallest for organic eggs with respect to age. The loss decreased as age increased for vitamin enhanced eggs while the welfare loss increased as age increased for free run/range and organic eggs. A welfare change with respect to age for omega 3 eggs was not calculated because age was not significant in the both the choice model (Table 20) and the frequency model (Table 22). These results suggest that households appear to be willing to trade-off normal eggs for vitamin enhanced eggs as age increases while they are not willing to trade-off normal eggs for free run/range and organic eggs.

Table 28. Welfare Changes with Respect to children for the Choice Model

	Welfare Changes $	
Egg type	Children under 18	no children under 18
Omega 3	-0.78	-0.90
Free run/range	-2.67	-3.35
Organic	-0.39	-0.73
Vitamin enhanced	-5.42	-4.82

Table 29. Welfare Changes with Respect to children for the Frequency Model

	Welfare Changes $	
Egg type	Children under 18	no children under 18
Omega 3	-0.83	-0.61
Free run/range	-1.97	-1.45
Organic	-0.31	-0.07
Vitamin enhanced	-4.02	-4.68

Table 28 and Table 29 show that both households types with and without children under the age of 18 experienced a loss in welfare due to the presence of the non-normal eggs. The Welfare loss was higher for households with children at home under the age of 18 compared to households without children at home with respect to vitamin enhanced eggs for the choice model. While for the frequency model, the Welfare loss was highest for households with children at home under the age of 18 compared to households without children at home for all the egg types. Comparing the results from Table 28 and Table 29, the welfare loss was smallest for organic eggs, followed by omega 3 eggs and then free run/range eggs and lastly, vitamin enhanced eggs. These results suggest that households with and without children under the age of 18 appear to not be willing to trade-off normal eggs for non-normal eggs.

Table 30. Welfare Changes with Respect to Total Food Expenditure for the Choice Model

	Welfare Changes $			
Expenditure	Omega 3	Free run/range	Organic	Vitamin
500	-0.92	-3.28	-0.67	-4.80
1000	-0.94	-3.21	-0.61	-4.77
1500	-0.96	-3.14	-0.55	-4.75
2000	-0.99	-3.07	-0.49	-4.73
2500	-1.01	-3.00	-0.43	-4.70
3000	-1.03	-2.93	-0.37	-4.68
3500	-1.06	-2.86	-0.31	-4.66

Table 31. Welfare Changes with Respect to Total Food Expenditure for the Frequency Model

	Welfare Changes $			
Expenditure	Omega 3	Free run/range	Organic	Vitamin
500	-0.63	-1.37	-0.01	-4.70
1000	-0.66	-1.30	0.06	-4.73
1500	-0.69	-1.23	0.12	-4.76
2000	-0.71	-1.16	0.19	-4.79
2500	-0.74	-1.09	0.26	-4.81
3000	-0.76	-1.02	0.32	-4.84
3500	-0.79	-0.94	0.39	-4.87

Table 30 shows that households experienced a loss in welfare as total food expenditure increased with respect to omega 3, free run/range and vitamin enhanced eggs and organic eggs for the choice model while Table 31 shows that households experienced a loss in welfare as total food expenditure increased with respect to omega 3, free run/range and vitamin enhanced eggs while households experienced a gain in welfare as total food expenditure increased for organic eggs. The major difference in the results from the choice model and the frequency model is the positive welfare changes associated with organic eggs as total expenditure increases. Despite this difference the trend in the results are similar for both models as total food expenditure increases.

The welfare loss was highest for vitamin enhanced eggs and smallest for organic eggs with respect to total food expenditure. The loss decreased as expenditure increased for free run/range eggs, organic eggs and vitamin enhanced eggs while the welfare loss increased as expenditure increased for omega 3 eggs in the choice model.

The welfare loss decreased as expenditure increased for free run/range eggs while the welfare loss increased as expenditure increased for organic eggs and vitamin enhanced eggs with regards to the frequency model. The results show that households

appear to be less willing to trade-off normal eggs for omega 3, free run/range and vitamin enhanced eggs as total food expenditure increases. The opposite is true with regards to organic eggs.

5.3. Conclusion

The conclusion and discussion of the results in this section will rely mostly on the results obtained from the frequency model. The frequency model is chosen for the discussion because it is viewed as a more reliable model than the choice model because it accounts for the multiple purchases by households in a single trip or purchase occasion. Income was found to have a positive but very minimal impact on demand for omega 3, free range run and vitamin enhanced eggs, and a negative but minimal effect on the probability of selecting organic eggs. Income was found to have an impact on the probability of selecting normal eggs. The significant and positive results associated with omega 3, vitamin enhanced and free run/range eggs are understandable as one would expect that since these products are more expensive compared to the normal or base egg type; income plays a major role in their selection. Income was found to have a negative effect on the probability of purchasing organic eggs. One possible explanation for the negative income coefficient on organic eggs could be that we would expect as people get older they would have greater expenditure income. Since it was identified that older people buy less organic products (Cunningham, 2004), the negative income effect on the choice of organic eggs may be a reflection of this finding. The very minimal impact of income on the selection of the respective egg types as shown by the marginal effects agree with some of the earlier demand studies that showed income to have no impact on egg demand (Hassan and Johnson, 1976; Johnson and Safyurtlu, 1984; Andrikopoulos and Carvalho,

1984; Barewal and Goddard, 1985; Chyc and Goddard, 1992). Another, possible explanation for the minimal impact of income on egg purchase is that compared to other food products eggs are inexpensive and change in income likely has a minimal or no effect on the probability of purchasing eggs.

Presence of children was found to a positive impact on the probability of purchasing omega 3 and vitamin enhanced eggs. This result is as expected since we would assume that households with children would be more health conscious and therefore would be more inclined towards purchasing food products that have health claims attached to them. Presence of children was found to have a negative effect on the probability of purchasing organic eggs and free run/range eggs. The negative impact of presence of children under 18 on the probability of purchasing organic eggs supported by Batte et al's study (2004) that found that families with children aged 15 and younger were less likely to select organic food products. Contrary to our result, the study by Loureiro, McCluskey and Mittelhammer (1999) showed that consumers with children under the age of 18 and have strong environmental and food safety concerns were more likely to purchase organic apples. Thus, the negative effect of presence of children in a household on the probability of purchasing organic eggs should not come as a surprise since some studies (Batte et al, 2004; Cranfield and Magnusson, 2003) have a similar result.

Our result is supported by the study by Cranfield and Magnusson (2003) who in their evaluation of Canadian Consumer's willingness to pay for pesticide free food products found that as the ratio of number of children in the household under the age of 17 rises relative to the number of people in the household, the probability of being willing to pay no premium or a less premium than six percent increases. One explanation that

Cranfield and Magnusson (2003) and Loureiro, McCluskey and Mittelhammer (1999) gave for this result is that the more children there are in the home, the more the household's budget constraint limits the extent to which one can pay a higher price for food products that are desirable. That is to say households with larger families may have been conditioned by their customary shopping habit towards being less likely to purchase differentiated egg products since they are more expensive. This may be due in part to the fact that larger households are used to purchasing low-cost items to economise food budgets. Thus, one can argue that larger households may be more conservative and as a result are less interested in the value added or designer egg products.

However, presence of children in a household is an important demographic that is and will play a major role in determining the growth of the differentiated eggs market. Thus, providing a relatively low priced differentiated egg product may be more attractive and appealing to households with children under the age of 18 at home.

Age was found to have a negative impact on the probability of purchasing free run/range and organic eggs and a positive impact on the probability of purchasing vitamin enhanced eggs. The positive impact of age on the probability of purchasing vitamin enhanced eggs is expected and a similar result was expected for omega 3 and organic eggs; this however did not hold for the latter egg types as is shown above. Thus, it could be argued that older people are less familiar with the new products and are thus less likely to purchase these products unless the benefit associated with a particular egg product is explained. And even then, older people may be accustomed or attached to a particular product and thus are less likely to purchase the differentiated egg products that are relatively new to the egg market.

Thus, even though age was found not to be significant with regards to omega 3 eggs, and was found to be significant but have a negative impact on the probability of purchasing organic and free run eggs, it is imperative that the industry recognize that age is a factor that will affect the demand for these products. Oliviera (2003) states that one-quarter of the Canadian population was aged 45 to 64 in 2001. Oliviera notes that this group should make up one third of the population by 2011. It was started earlier that one of the reasons that older people may not be purchasing these new products is because they may be accustomed to consuming more familiar products and may not be understanding some of the claims on the new products. Oliviera (2003) notes that even with good health, eating habits, physical activity and other healthy ways of living, there are certain factors that come with an aging population such as increases of arthritis, high blood pressure, high cholesterol level and many other health conditions. Since there is a new trend towards being more responsible personally for health there will be increased interest in functional food that may be geared towards addressing these problems. Eggs have been identified as a nutritiously dense food product. This means that eggs provide a good portion of needed nutrients for the calories that they provide (Alberta Egg Producers, 2006). Thus, eating nutritiously dense foods has been identified as particularly important for children as well as older people because their energy needs are less but their nutrient needs are high (Alberta Egg Producers, 2006).

The coefficient on total food expenditure is positive and significant for all for free run/range eggs and organic eggs and negative and significant for omega 3 and vitamin enhanced eggs. This result suggests that an increase in total food expenditure will result in an increase in the probability of purchasing free run/range and organic eggs and

decrease the probability of purchasing omega 3 and vitamin enhanced eggs. Thus, households may be preferring free run/range and organic eggs over omega 3 and vitamin enhanced because these egg types are viewed as important attributes such as food safety, animal welfare and health/nutrition. A similar argument was presented by Harper and Makatouni (2002), Batte et al. (2004), Gerhardy and Ness (1994), Hobbs (2004) and Phan-Huy and Fawaz (2003).

The price elasticities of choice were also calculated for both the choice model and the frequency model. The price elasticity of choice probability shows the percent change in choice probability with respect to a one percent change in price. From the two models that were estimated own-price elasticities of choice probabilities indicated that all egg types were highly elastic with the exception of normal eggs. Different egg types on the same grocery store shelf are much closer substitutes than the more aggregated food categories used in the earlier demand studies (Hassan and Johnson, 1976; Kulshreshtha and Ng, 1977; Johnson and Safyurtlu, 1984; Andrikoploulos and Carvalho, 1984; Curtin, Theoret and Zafiriou, 1987; Barewal and Goddard, 1985; McCutcheon and Goddard, 1991; Chyc and Goddard, 1992 and Hailu and Goddard, 2004). The results in this study are consistent with microeconomic theory which suggests that the more substitutes a product and the closer they are, the more elastic will be the response to price changes.

Welfare calculations were also done for each egg type. The welfare calculations were based on the estimates for both the choice and frequency models. Economic welfare impacts were calculated evaluating how the welfare changed as household demographics changed. In all but one of these situations, households experienced welfare losses with the introduction of the differentiated egg types; the result that where obtained were as

expected since based on our data set, households purchased more of normal eggs than the non-normal eggs. The welfare losses were smaller for organic eggs, followed by omega 3 eggs, and then free run/range eggs and lastly, vitamin enhanced eggs when all the demographics were considered for both model. As income increased WTP to pay for omega 3 eggs, free run/range eggs and vitamin enhanced eggs increased while the willingness to pay for organic eggs decreased. Despite the decrease in WTP for organic, the welfare change was still small compared to the other egg types.

As age increased the WTP for all egg types decreased with the exception of vitamin enhanced eggs. Once again welfare loss was smallest for organic eggs, followed by free run/range eggs. Vitamin enhanced eggs experienced a decrease in the welfare loss as age increased. As for presence of children, the welfare loss was smallest for households without children under the age of 18 at home compared to households with children under the age of 18 at home. Once again the welfare loss was smallest for organic eggs followed by omega 3 eggs, free run/range eggs and lastly, vitamin enhanced eggs.

The welfare estimates calculated with total food expenditure changing produce very interesting results with regards to the frequency model. There was welfare loss associated with each type of egg except organic eggs which had welfare gain as total expenditure increased. As total food expenditure increased WTP for organic eggs and free run/range eggs increased while the WTP for omega 3 eggs and vitamin enhanced eggs decreased.

The WTP estimates obtained from this study do not support the hypothesis and findings from the previous studies that people/households are willing to pay a premium

for differentiated/designer egg products. However, the pattern of the welfare impact/estimates for each of the differentiated egg products is supported by the previous research. The willingness to pay was highest for organic eggs. This result is supported by Baltzer's (2003) study that found consumers were willing to pay the highest premium for organic eggs. Travisi and Nijkamp (2004) found that on average, respondents were willing to accept substantial willingness to pay premiums for agricultural goods: particularly food stuffs produced in environmentally friendly ways. This high premium for organic eggs is also explained by Harper and Makatouni's study (2002) that concluded that even though health and food safety concerns are the main issues that influence organic purchases (this argument is also supported by Batte et al's study, 2004), ethical concerns, specifically in regard to animal welfare play a significant role in the decision to purchase organic foods. Gerhardy and Ness's study (1994) revealed that freshness was one of the attributes that influenced consumers' willingness to select organic eggs. Thus, organic eggs may be viewed as a product that has multiple benefits hence, the high willingness to pay. This suggestion is supported by Hobbs' (2004) who found that consumers were willing to pay more for a sandwich that had traceability bundled with food safety and product method assurances for both beef and pork. Hobbs shows that consumers were willing to pay less for products that contained each of attributes individually.

The willingness to pay values for omega 3 eggs was lower as compared free run/range eggs and vitamin enhanced eggs. The willingness to pay values for omega 3 eggs may be interpreted as a willingness among consumers/households to pay a premium for egg products with health claims particular those with additional omega 3 ingredients.

The higher premium free run/range eggs over the vitamin enhanced eggs may be interpreted as households' preference for eggs produced from hens that were subject to better treatment (i.e. animal welfare).

One important observation from the welfare measures is that the products that were most purchased (organic and omega 3) had higher willingness to pay values as compared to those that were least purchased (i.e. free run/range and vitamin enhanced eggs respectively). This may suggest that the households may be slightly familiar with organic eggs and omega 3 eggs compared to free run/range eggs and vitamin enhanced eggs. These finding may be a clear indication that households are confused about the different egg products that have been introduced in the shell egg market. Thus, it can be reasonably concluded that with a slight reduction in the prices of non-normal eggs and proper labels that make households understand the gains and benefits associated with consuming the non-normal eggs types, retailers and the egg industry as a s could decrease the welfare loss associated with the different non-normal egg types.

Chapter 6 Summary, Conclusions and Market Implications

6.0. Summary and Conclusions

Chapter 1 began with a brief overview of the Canadian egg sector. It was established in this chapter that Canadian per shell capita egg consumption had been declining in the last few decades. Issues regarding health and nutrition, food safety and later environmental and animal welfare concerns may have been factors that were contributing to this decline. However, recently egg consumption has been on the rise. This rise has partially been attributed to the Harvard study that found that there was no connection between cholesterol and egg consumption (Hu et al., 1999). Also, industry led initiatives such as the adoption of HACCP, animal welfare and environmental programs can be credited for the rise in the per capita egg consumption. Due to the consumer concerns and industry led initiatives there has been an introduction of new egg products such as omega 3 eggs, vitamin enhanced eggs, organic eggs and free run eggs. As was shown in Chapter 1 these products are readily available in numerous grocery stores around Alberta and Canada. It is possible that the egg industry developed these products with the intention of addressing specific consumer concerns with regard to the food that they eat.

The problem however, is that most of these developments have occurred mainly on the supply side and very little is known about how consumers are responding to these new products. Thus, the objective of this thesis was to provide a better understanding of how Alberta consumers were responding to the new industry led initiatives. Questions such as: What products do people buy? Who are the customers? What products does the industry sell and how does the industry maintain its competitiveness were posed in Chapter 1.

The discussion in Chapter 2 proceeded to indicate how these questions could be answered using previous literature. The discussion in Chapter 2 highlighted the importance of economic consumer theory, neoclassical economic theory and issues surrounding time series cross sectional and longitudinal data in answering the questions posed in Chapter 1. A summary of previous Canadian studies dealing with issues of food safety, animal welfare, environment and health, the economic concept of value, methods of measuring economic value such as the revealed and stated preference methods, and product differentiation were also presented in Chapter 2. The last section in Chapter 2 highlighted the contributions of other studies that were not conducted in Canada but dealt with issues surrounding food safety, animal welfare and so on. Thus, the material presented in Chapter 2 helped highlight the importance of socio-economic demographics such as age, household size, and income, presence of children, animal welfare concerns, food safety concerns, environmental concerns and health and nutrition concerns on people's willingness to choose and pay for egg products. This chapter helped provide some hypotheses for the empirical analysis. A brief description of the methods that were to be used to carry out the analysis is provided in Chapter 3. The nested logit model and multinomial logit models were introduced as models that could be used for our analysis final analysis.

In Chapter 4 the description of the data and hypotheses and a priori expectations are discussed. Two models were introduced, one with choice as the dependant variable and the other with total number of eggs purchased per dozen as the dependant variable. In chapter 5, a nested logit model and two conditional logit models were estimated with the intention of examining how price and households' socio-economic and demographic

characteristics influenced the households' choice of egg type. In all the three models prices and household demographics were found to have an impact on the household's choice of eggs. However, for this study, only the results from the conditional logit model with total number of eggs purchased per dozen per egg type (frequency model) were discussed and compared to the previous studies. This model was selected over the choice model because the frequency model accounts for multiple purchases of different egg types on a single trip while the choice model does not.

The results from the frequency model showed that overall egg price was one of the key determinants of choices of egg types. Household's socio-economic and demographic characteristics were found to affect household's choices of egg types significantly. Households with high income and with no children under the age of 18 at home and with low total food expenditure were more likely to purchase omega 3 eggs. Age was found to have no impact on the probability of purchasing omega 3 eggs. Households with a young head of the family and with high incomes and food expenditures and with no children under the age of 18 in the household were more likely to purchase free run/range eggs. Smaller households with high incomes and food expenditures and with no children under the age of 18 in the house and with a young head of the household were more likely to purchase free run/range eggs. Households with a young head of the household, with no children under the age of 18 in the household, with lower income and with higher food expenditures are more likely to purchase organic eggs. Households with an older head of the household, with children under the age of 18 in the household and with high income and low food expenditure are more likely to purchase vitamin enhanced eggs.

Some of the interesting results found in this thesis relate to the price elasticities of choice probabilities. The price elasticity of choice probability shows the percentage change in choice probability with respect to a percentage change in price. From the two conditional logit models, the estimated own-price elasticity of choice probabilities indicated that all the differentiated egg types were highly price elastic while the normal eggs were price inelastic. Thus, different egg types on the same grocery store shelf are much closer substitutes than the more aggregate food categories used in the earlier demand studies. This result may be a strong indication of luck of understanding of the different benefits and gains associated with the different egg types. This result is also consistent with microeconomic theory which suggests that the more substitutes a product has the more elastic will be the response to price changes.

Also, in all but one of the situations the households experienced a welfare loss with the introduction of the differentiated egg products. Despite the negative willingness to pay premiums associated with all the different egg types as household income increased, the welfare loss associated with the purchase of omega 3, free run/range and vitamin enhanced eggs decreased while the welfare loss associated with organic eggs increased. Despite the increase in the welfare loss associated with organic eggs, compared to the other egg types the welfare loss associated with organic eggs was slightly smaller. One of the interesting results is relation to total food expenditure. As total food expenditure increased welfare associated with organic eggs also increased to include positive willingness to pay values while the welfare loss associated with omega 3 eggs and vitamin enhanced eggs increased as total food expenditure increased. In conclusion, despite the welfare loss associated with the different egg types, WTP a

premium comparing the different egg types was highest for organic eggs, followed by omega 3 eggs, then free run/range eggs and lastly, vitamin enhanced eggs. A possible explanation why the organic eggs have higher willingness to pay values compared to omega 3, free run/range eggs and vitamin enhanced eggs is that households view the former egg type as having multiple attributes compared to the later which are viewed as having only health claims or animal welfare claims.

6.1. Thesis Findings and Market Implications

Most of the studies examined in this thesis agree that there is increased consumer concern and awareness towards issues surrounding animal welfare, food safety, environment and lastly, health and nutrition. This study provides some insights into the marketing of egg products in the Alberta egg market.

The independent variables examined in the regression were household income, age of the head of the family, presence of children and total expenditure. Household size was omitted in the final analysis because it was found to be significantly and positively correlated with the presence of children variable and total expenditure. The results from the final analysis suggest that socio-economic and demographic characteristics influence household's perceptions of egg attributes. Thus, it is important for egg producers and processors to recognize the heterogeneity of the Alberta egg consumers.

The study revealed that the type of households purchasing omega 3 eggs are those with no children under the age of 18 at home with more expendable income and low total food expenditure. Age was not found to be significant. Other types of households may not be purchasing omega 3 eggs because they do not understand the benefits that are associated with consuming them. Thus the marketing campaigns by egg producers,

processors and retailers should focus on trying to elaborate the benefits associated with purchasing and consuming omega 3 eggs.

The households who are purchasing free run/range egg seem to be young professionals and with no children under the age of 18 at home and have more expendable income and spend more on food. Young adults, with no children at home, with low income and low total expenditure seem to be the major purchasers of organic eggs. This finding is supported by Magnusson and Cranfields' (2005) research which reports that that younger people were willing to pay a premium for PFP (Pesticide Free Products) food products. Thus, organic egg producers, processors and retailers should focus their campaigns on the multiple benefits that older people and households with children can get from consuming organic eggs.

Households who are purchasing vitamin enhanced eggs tend to have an older head of the household with more disposable income, with children at home and low total food expenditure. From, the above results, it is apparent that the market for non-normal eggs is limited to a particular segment of households. It is not only important for the Alberta egg producers, processors and retailers to know who is buying what product; it is also important for them to know who is not buying the product and why.

One possible explanation as to why these products are not being purchased is that consumers may not be understanding the claims that are being made. It may be the current trend that consumers are interested in products that are geared toward their respective concerns but this does not necessarily mean they will buy such a product. Thus, in order for the egg producers, processors and retailers to exploit these consumer concerns by producing specific products, it is important that the egg industries advertising

campaigns state the benefits that the respective egg products will have on both the households that are already purchasing the products and those that are not.

Similarly, the Canadian population is aging (Oliviera, 2003). It was identified that most of the purchasers of non-normal eggs tend to be young. It was also argued that older people may be less inclined purchase non-normal eggs because they do not understand the claims that attached to the new products. And also, older people tend to be less inclined towards trying new products. Since the Canadian population is an aging one it may be important for the egg producers, processors and retailers to stress the health benefits that consuming the new products may present to the older people. Thus, it is imperative that the Albert egg industry recognize this new trend in the demographic profile of the population by stating not only the health, environmental, food quality aspects of eggs but also they should stress the convenience (easy to prepare, soft and easy to digest) aspects associated with eggs.

With the exception of normal eggs, all the non-normal eggs were found to have a high own-price elasticity of choice. A one percent increase in the price of any of the non-normal eggs reduced the probability of purchasing the non-normal eggs by over one percent. Thus, it appears that households are purchasing less of the non-normal eggs because they are viewed as slightly more expensive compared to the normal eggs. This high price elasticity of the probability of choice may also be due to the lack of understanding of the claims that many of these non-normal egg types have and consequently, consumers may be view each of the egg types as perfect substitutes. Thus, it is imperative that the egg industry convey clearly the benefits that households would gain from consuming the individual differentiated egg products.

The hypothesis that Alberta egg consumers are willing to pay for the different egg products was inconclusive. When the calculations were performed we found that the WTP for the different egg types was negative which suggests that households experienced a loss in their welfare through the introduction of the non-normal eggs. This result is not normal given the fact that the non-normal eggs were introduced to address legitimate consumer concerns (animal welfare, health and nutrition, food safety and environmental concerns) as is shown in the literature review and is also repeated throughout this thesis. One possible explanation for the negative willingness could be the small number of purchases of the non-normal eggs with vitamin and free run/range eggs being the least purchased. Thus, if more information or data is collected on the purchases of the non-normal eggs, a different result could be realized. For instance, when consumer's demographics were changed so as to see how the welfare measures changed, most of the premiums associated with each of the egg types increased and in fact WTP for organic eggs even become positive as total expenditure increased. Thus, the hypothesis that consumers are willing to pay a premium for the respective egg types could not be completely rejected. This premium was highest for organic, omega 3, free run/range vitamin enhanced eggs respectively. One reason that could be identified for the high willingness to pay for the organic eggs is that they, could be viewed by consumers as containing multiple credence attributes (good food quality, fresh, health and environmentally friendly) compared to the other egg types. This hypothesis is supported by the studies of Harper and Makatouni (2001), Batte et al. (2004), Gerhardy and Ness (1994), Hobbs (2004) and Phan-Huy and Fawaz (2003), Anderson (2003). Thus, egg processors, egg wholesalers, egg retailers and egg producers should not only focus on the

health attribute of eggs but rather they should emphasize the food safety, environmental and animal welfare attributes.

One effective strategy is to develop a product with multiple attributes and to build specific brands which emphasize safety, health, animal welfare and environmental attributes. The price elasticity of choice that were calculated show organic, omega 3, free run/range and vitamin enhanced eggs as being highly price elastic compared to conventional eggs. These high price elasticities of choice may be a reflection of the consumer confusion and lack of understanding of the benefits and claims associated with some of the non-normal eggs. Also, these results seem to suggest that the higher prices associated with the differentiated egg types seem to be the major deterrence for their purchase. One possible solution to this problem is that egg producers and processors could adopt mid-priced products with proper marketing communication. A similar recommendation was proposed by Fearne and Lavelle (1996), Batte et al (2004).

In the earlier Canadian studies eggs were treated as a homogeneous product. In this study, it was shown that people view eggs as a differentiated egg product. Currently, the number of eggs that are produced are constrained to the quota limit that has been set by CEMA. This constraint implies that if egg producers intend to produce any of the differentiated egg products they have to do so under the framework of the quota level in place. Since it has been identified that consumers are becoming more familiar with the new egg products it may be time for the egg industry to revise the supply management system and attempt to increase the quota limit so that more differentiated egg products can be available to the consumers. This will enhance competition in the egg market and will also encourage the growth and development of the differentiated egg market. From

the data provided from and discussed in Chapter 4 it is apparent that there are fewer differentiated egg market compared to the normal eggs and thus there is need to increase the production as it has been identified that consumers are willing to pay a premium for the non-normal eggs.

Henry (2002) notes that recently poultry producers have seen their market disappear as wholesalers are discontinuing local purchases in favour of a source that could supply the entire region. Given this new trend in the egg industry, the production of non-normal eggs coupled with the right price and increased understanding of the benefits associated with each of the differentiated egg types, posses a great opportunity to many eggs producers to remain in the egg market and still be competitive.

6.2. Limitations and Recommendations for Further Study

A limitation of this study is that the definition of frequent egg purchasers (30 plus purchase occasions) may have been too stringent. In the data set provide some households were frequent purchasers in the first 13 months, while others were frequent purchasers in the first 26 months. By relaxing, the assumption from 30 purchasing occasions out of the 39 purchase occasions to frequent egg purchasers based on 13 months periods and ignoring the 13 months period where households never purchased any eggs at all, the number of households and alternatives (especially the non-normal eggs) purchased by households in the sample would have been high compared to the present sample. This however, would not undermine the fact that the number of non-normal eggs purchased was still small compared to the normal eggs.

Also, the study was limited by the demographic variables available such as gender and culture/ethnic diversity. Gender has been sighted as a major factor that affects the

preference for foods purchased in a household. Reynolds-Zayak (2004) states that food trends such as convenience, health eating and ethically diverse foods are to some extent a results of women's influence at home. "In 2000, the NDP Group's Net Canada Nutrition Survey 2000, reported that the female head of the household planned 84 % of evening meals that were prepared and consumed in the home" (Reynolds-Zayak, 2004, p8). Thus, gender as an independent variable would have provided some interesting insights on the demand for differentiated egg products.

In 2001 Canada Census Data reported that 18.4 per cent of Canada's population which is equivalent to 5.4 million people was born outside of Canada (Reynolds-Zayak, 2004). Statistics Canada (2003) reported that people who immigrated to Canada in the 1990's were mainly born in Asia, the Middle East, Europe, the Caribbean, Central and Southern America, Africa and the United States. Thus, exploring how immigrants are responding and perceiving these egg industry led initiatives may be of great interest as the immigration is one that is growing and will continue to grow over the next years.

Also, there is need for a detailed comparison of Alberta urban and rural split population with broader Canadian census population or with a province like Ontario. This could enable comparisons to be made on how households in the different provinces are reacting to the egg industry's led initiatives (See Table 18). Also, these comparisons may make it possible for one to make more generalized statements on how Canadians are reacting to the new egg industry led initiatives.

Another limitation of this study is that the data with 2635 households and 292 households was not quite representative of the Alberta, Ontario or Canadian population. Looking at Table 18 in chapter 5 one can see that the demographic composition in terms

of age, presence of children at home and household income is almost the same in Ontario and Alberta and Canada as a whole. Comparing these demographic profiles to the orginal data with 2635 households and the sample data of 292 households that was used for the final analysis, one can see that the income composition and the age of the head of the household varies quite considerably from the Alberta, Ontario and the Canadian census data (see Table 17 and Table 18). The lower income groups from the 2635 households and the sample data of 292 households were much smaller compared to the Alberta, Ontario or Canadian census data.

Also, the sample data of 2635 households and the sample of 292 households used for the analysis had more households in the higher income brackets. In fact as we moved on to the higher income groups the sample data become larger while the Alberta, Ontario and Canadian census income groups got smaller (see Table 17 and Table 18). Thus, the results in our analysis may be a good representation of how people in the higher income brackets in Alberta are responding to these new value added products.

Further, the lower age group in the sample data with 2635 households and the sample data with 292 household used for the analysis are not representative of the age profiles as shown by the Alberta, Ontario and/or Canadian census profiles. The smaller age group is underrepresented in both the sample data with 2635 households and the sample data with 292 households (Table 17 and 18); however, the age groups between 25-44 years, 45-54 years and 55-64 years even if slightly smaller compared to the Alberta, Ontario and Canadian census data seem to be a fair representation of the population profiles (see Table 17 and Table 18). The age group 65 and over are over-represented in the sample data of 2635 households and the sample of 292 households.

The sample data with 2635 households and 292 households is a good representation of the presence or absence of children at home under the age of 18. Thus, the results from the analysis best capture the behaviour of households with higher incomes, with a head of a family who is 25 years and older and may or may not have children at home under the age of 18.

Also, people's attitudes towards health, nutrition, animal welfare and the environment may be having a major impact on how households and consumers are choosing what they eat. Thus, adding people's attitudes to the revealed preference data would have made the results from the analysis richer and may also enable the use of more generalized statements of how people would behave if they had to choose products that have the above claims. In this study, when a household chose an egg type we made an assumption that they chose that particular egg type because they cared about the issue or issues that where claimed to have been addressed when the egg was produced. This assumption alone may not be sufficient in explaining why household chose to or not to purchase a particular egg type.

Further research could entail including household's attitudinal behaviour. This could be obtained through surveys. Since households demographic profiles that were used in this analysis were collected through a questionnaire, this questionnaire could be expanded to include attitudinal type questions.

Also, further research would entail trying to explore the impact of gender and ethnic diversity on the demand for the non-normal egg products. Clearly, the results we obtained from this study were limited by the sample that we had. The sample population that was used in the study was/is not representative of Alberta, Ontario or Canada as a

whole (See Table 17 and 18 for the comparisons in the population profiles of the sample data, Alberta population, Ontario population and the Canadian population as a whole). Thus, one could increase the sample of Alberta by using an unbalanced panel by picking 13 months periods that show that households purchased frequently. This sample would end up including only those time periods when households were frequently in the sample.

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Appendices

Appendix 1. Summary of Events in the Canadian Egg Industry

Year	Event
1968	The Canadian Egg producers Council and the Canadian Federation of Agriculture hold the first national conference of egg producers.
1971	The Farm Products Marketing Agency Act becomes law.
1972	The Canadian Egg Marketing Agency is formed (Supply management begins).
1975	Central Selling is introduced.
1985	Supply management is challenged by the MacDonald Royal Commission which recommends that the system should be dismantled. This very same year CEMA launched a multi-media marketing campaign.
1989	The Canadian and US Free Trade Agreement becomes law. And the US wants supply management to be dismantled.
1990	CEMA launches the Safe from Salmonella program following outbreaks of salmonella in Europe. Start Clean-Stay Clean on-farm safety program is developed (Canadian Food and Inspection Agency, 2005).
1992	Pricing is decentralized (Pricing returned to provinces).
1993	Variable levies are introduced due to the growing egg processing sector. Also, multilateral trade negotiations are concluded with the introduction of tariffs to GATT article XI border controls.
1995	The new multilateral agricultural trade agreement comes into effect.
1996	The US challenges the Canadian import tariff under the NAFTA agreement. Per capita egg consumption of eggs increases and for the first time national allocation quotas go over the base established in 1972.
1997	CEMA coordinates research required by health Canada on the marketing of omega-3 eggs. Study on usage and attitude towards eggs confirms that consumers are less concern about cholesterol and are more knowledgeable about the nutritional merits of eggs. Canadian On-Farm Food Safety (COFFS) programs are launched. These programs are funded by Rural Development

	Fund and Agriculture and Agri-Food Canada.
1998	The Start Clean-Stay Clean program of on-farm food safety is modified to include HACCP principles. The Supreme Court of Canada rules supply management is consistent with the Charter of Rights and Freedoms.
1999	Harvard School of Public Health concludes most people can safely eat one egg per day. Also a revised nutrient analysis shows a reduction in fat and cholesterol content of eggs which could be explained by improvements in breeding and layer diets.
2000	Health Canada proposes mandatory nutritional labeling.
2001	New round of multilateral trade talks begins. CEMA launches a web site independent of its corporate web site that is exclusively dedicated to promoting eggs (www.eggs.ca). Also in this year the Canadian Poultry Research Council is created.
2002	The committee of the Canadian Poultry Research Council invites scientists to collaborate on research projects to enhance shell eggs. The Canadian Agri-Food Research Council establishes the Code of practice for the care and handling of pullets, layers and spent fowl.
2003	Canadian ate an average of 15.6 dozen eggs per person a 1.3 % increase over 2002 (CEMA, 2004).
2004	Start Clean-Stay Clean on-farm safety program is sent for technical review to the Canadian Food Inspection agency by CEMA so that it can be recognized as a technically sound program that meets the regulatory requirements and adheres to HACCP principles.

Appendix 2. Frequency Distributions by Egg Type for the Original 2635 households

Table 1: Frequency distribution across egg types and household size (2635 hhlds)

	Household size (%)									
	1	2	3	4	5	6	7	8	9 plus	Egg Share
Normal	87.70	89.55	90.10	89.25	89.95	90.91	96.67	100.00	100.00	89.36
Omega 3	2.83	2.08	2.47	2.47	2.05	0.48	0.00	0.00	0.00	2.30
Free Run/Range	2.57	1.62	1.08	1.00	0.68	1.44	0.00	0.00	0.00	1.49
Organic	5.67	5.76	5.84	6.42	6.51	7.18	3.33	0.00	0.00	5.95
Vitamin	1.23	0.99	0.51	0.87	0.80	0.00	0.00	0.00	0.00	0.90
Total share	16.32	39.85	13.75	20.12	7.64	1.82	0.26	0.09	0.14	100.00

Table 2. Frequency distribution across egg types and household income (2635 hhlds)

	Household income (%)					
	Normal	Omega 3	Free run/range	Organic	Vitamin	Income shares
Under $10,000	1.26	0.76	1.17	1.17	0.00	1.23
$10000-$14999	2.41	2.66	1.75	2.93	0.00	2.42
$15000-$19999	2.59	1.14	1.75	2.35	0.97	2.51
$20000-$24999	5.53	1.90	3.51	4.11	0.97	5.29
$25000-$29999	4.12	3.42	5.26	3.52	6.80	4.11
$30000-$34999	6.47	4.18	3.51	6.01	2.91	6.32
$35000-$39999	4.92	6.46	9.94	5.28	4.85	5.05
$40000-$44999	5.75	7.60	6.43	5.87	4.85	5.80
$45000-$49999	5.29	3.80	7.02	5.43	2.91	5.27
$50000-$54999	7.29	6.46	5.85	6.30	4.85	7.16
$55000-$69999	16.85	13.31	13.45	16.13	9.71	16.61
$70000-$84999	13.29	16.35	10.53	12.46	18.45	13.32
$85000-$99999	9.49	7.22	10.53	9.97	15.53	9.54
$100000-$124999	8.10	14.45	8.77	9.97	9.71	8.38
Over $125000	6.64	10.27	10.53	8.50	17.48	6.99
Egg type share	89.36	2.30	1.50	5.95	0.90	100

Table 3. Frequency distribution across egg types and age (2635 hhlds)

	Age of head of the household (%)					
	Under 35	35-44	45-54	55-64	65 and over	Egg type shares
Normal	87.12	88.77	89.35	89.89	90.54	89.36
Omega 3	4.37	2.54	1.91	1.90	2.18	2.30
Free						
Run/Range	2.55	1.29	1.79	1.34	1.07	1.49
Organic	4.98	6.36	5.90	6.13	5.63	5.95
Vitamin	0.97	1.05	1.06	0.73	0.58	0.90
Age share	7.18	25.80	28.83	20.20	17.99	100.00

Table 4. Frequency distribution across egg types and presence of children (2635 hhlds)

	Presence of children (%)		
	Children Under 18	No Children Under 18	Egg type shares
Normal	89.28	89.40	89.36
Omega 3	2.39	2.25	2.30
Free Run/Range	1.01	1.73	1.49
Organic	6.56	5.66	5.95
Vitamin	0.77	0.96	0.90
Size share	32.87	67.13	100.00

Appendix 3. UPC Codes, Brand and Manufacturer Description

UPC	UPC Description	# of Eggs	Manufacturer Description	Brand Description	Sub Brand Description
656510012	BURNBRAE FARMS GRADE A LARGE 1	12	BURNBRAE FARMS	BURNBRAE FARMS	Normal
1111060902	KROGER GRADE A MEDIUM 12S (CL)	12	CONTROL LABEL	KROGER	Normal
1540022035	WESTERN FAMILY GRADE A EX LARG	12	CONTROL LABEL	WESTERN FAMILY	Normal
2259611111	EGGS GRADE A JUMBO12S (#11 111	12	UNBRANDED	UNBRANDED	Normal
2308200011	EGGS GRADE A LARGE12S (#00 011	12	UNBRANDED	UNBRANDED	Normal
4115480004	DECOSTER GRADE A MEDIUM 12S	12	DECOSTER EGG FARM	DECOSTER	Normal
4130300402	FOODLAND GRADE A MEDIUM	12	CONTROL LABEL	FOODLAND	Normal
4130300403	FOODLAND GRADE A LAR	12	CONTROL LABEL	FOODLAND	Normal
4130300404	FOODLAND GRADE A EX LARGE	12	CONTROL LABEL	FOODLAND	Normal
4130300405	LOFOOD GRADE A LARGE 12 S (CL)	12	CONTROL LABEL	LO FOODS	Normal
4130300420	FOODLAND GRADE A SMALL	12	CONTROL LABEL	FOODLAND	Normal
4130300421	FOODLAND GRADE A MEDIUM	12	CONTROL LABEL	FOODLAND	Normal
5551210420	BUY LOW FOODS GRADE A LAR	12	CONTROL LABEL	BUY LOW	Normal
5551210430	BUY LOW GRADE A MEDIUM 12S (C.	12	CONTROL LABEL	BUY LOW	Normal
5568501002	KINGSMILL POWDER EGG REPLACE		KINGSMILL FOODS	KINGSMILL	**Processed**
5574205053	IGA GENERIC GRADE A MEDIUM 12S	12	GENERIC LABEL	I G A	Normal
5574205055	IGA GENERIC GRADE A EXTRA LARG	12	GENERIC LABEL	I G A	Normal
5574205056	IGA GENERIC GRADE A SMALL 12S	12	GENERIC LABEL	I G A	Normal
5574205057	IGA GENERIC GRADE A MEDIUM 12S	12	GENERIC LABEL	I G A	Normal
5574205058	IGA GENERIC GRADE A LARGE 12S	12	GENERIC LABEL	I G A	Normal
5574205059	IGA GENERIC EXTRA LARGE GRADE	12	GENERIC LABEL	I G A	Normal
5574205119	IGA GENERIC GRADE A EXTRA LARG	12	GENERIC LABEL	I G A	Normal
5574211195	IGA GENERIC SMALL GRADE A EGGS	12	GENERIC LABEL	I G A	Normal
5574211196	IGA GENERIC GRADE A MEDIUM 12S	12	GENERIC LABEL	I G A	Normal
5574211197	I G A GENERIC GRADE A LARGE12S	12	GENERIC LABEL	I G A	Normal
5574211198	I G A GENERIC GRADE A EX LARGE	12	GENERIC LABEL	I G A	Normal
5574233382	SMART CHOICE GENERIC GRADE A S	12	GENERIC LABEL	SMART CHOICE	Normal
5574233383	SMART CHOICE GENERIC GRADE A M	12	GENERIC LABEL	SMART CHOICE	Normal
5574233384	SMART CHOICE GENERIC GRADE A L	12	GENERIC LABEL	SMART CHOICE	Normal

UPC	UPC Description	# of Eggs	Manufacturer Description	Brand Description	Sub Brand Description
5574233385	SMART CHOICE GENERIC GRADE A E	12	GENERIC LABEL	SMART CHOICE	Normal
5579910101	CLAREMONTGRADE A EXTRA LAR	12	CLAREMONT POULTRY	CLAREMONT	Normal
5579910102	CLAREMONTGRADE A EX LARGE BRO	12	CLAREMONT POULTRY	CLAREMONT	Normal
5579910103	FRASER VALLEY GRADE A LAR	12	FRASER VALLEY FARMS	FRASER VALLEY	Normal
5579910104	CLAREMONTGRADE A LARGE BRO	12	CLAREMONT POULTRY	CLAREMONT	Normal
5579910105	CLAREMONTGRADE A MEDIUM	12	CLAREMONT POULTRY	CLAREMONT	Normal
5579910106	CLAREMONTGRADE A MEDIUM BROWN	12	CLAREMONT POULTRY	CLAREMONT	Normal
5579910107	GOLDEN VALLEY GRADE A SMALL 12	12	GOLDEN VALLEY	GOLDEN VALLEY	Normal
5579910110	CLAREMONTGRADE A JUMBO 12S(#1	12	CLAREMONT POULTRY	CLAREMONT	Normal
5579910113	GOLDEN VALLEY GRADE A LARGEFRE	12	FRASER VALLEY FARMS	GOLDEN VALLEY	Free Range
5579910114	GOLDEN VALLEY GRADE A LARGEFRE	12	FRASER VALLEY FARMS	GOLDEN VALLEY	Free Range
5579910147	GOLDEN VALLEY ORGANIC LARGE 12	12	FRASER VALLEY FARMS	GOLDEN VALLEY	Organic
5579910149	GOLDEN VALLEY ORGANIC MEDIUM 1	12	FRASER VALLEY FARMS	GOLDEN VALLEY	Organic
5579910301	GOLDEN VALLEY GRADE A EX LARGE	12	FRASER VALLEY FARMS	GOLDEN VALLEY	Normal
5579910303	FRASER VALLEY GRADE A LAR	12	FRASER VALLEY FARMS	FRASER VALLEY	Normal
5579910304	EGGS GRADE A LARGE	12	UNBRANDED	UNBRANDED	Normal
5579910305	CLAREMONTGRADE A MEDIUM	12	CLAREMONT POULTRY	CLAREMONT	Normal
5579910307	EGGS GRADE A SMALL	12	UNBRANDED	UNBRANDED	Normal
5579910309	FRASER VALLEY GRADE A PEE	12	FRASER VALLEY FARMS	FRASER VALLEY	Normal
5579910310	GOLDEN VALLEY GRADE A EXTRA LA	12	FRASER VALLEY FARMS	GOLDEN VALLEY	Normal
5579910311	CLAREMONT GRADE A EXTRA LARGE	12	CLAREMONT POULTRY	CLAREMONT	Normal
5579910503	CLAREMONTGRADE A LAR	12	CLAREMONT POULTRY	CLAREMONT	Normal
5579911101	GOLDEN VALLEY EXTRA LARGE 18S	18	FRASER VALLEY FARMS	GOLDEN VALLEY	Normal

UPC	UPC Description	# of Eggs	Manufacturer Description	Brand Description	Sub Brand Description
5580901666	BLOSSOM GRADE A LARGE 6S	6	MONKLAND EGG GRADING	BLOSSOM	Normal
5580902000	BLOSSOM ORGANIC GRADE A LARGE	12	MONKLAND EGG GRADING	BLOSSOM	Organic
5580904633	BLOSSOM OMEGA 3 GRADE A MEDIUM	12	MONKLAND EGG GRADING	BLOSSOM	Omega 3
5580924001	BLOSSOM GRADE A LARGE CLASSIC-	12	MONKLAND EGG GRADING	BLOSSOM	Normal
5580945001	BLOSSOM GRADE A EXTRA LARGEWHI	12	MONKLAND EGG GRADING	BLOSSOM	Normal
5580945002	BLOSSOM GRADE A EXTRA LARGE12S	12	MONKLAND EGG GRADING	BLOSSOM	Normal
5580945003	BLOSSOM LARGE EGGS 12 S	12	MONKLAND EGG GRADING	BLOSSOM	Normal
5580945005	BLOSSOM GRADE A SMALL	12	MONKLAND EGG GRADING	BLOSSOM	Normal
5580945006	BLOSSOM GRADE A PEE WEE 12S	12	MONKLAND EGG GRADING	BLOSSOM	Normal
5580945011	BLOSSOM GRADE A EX LARGE BRO	12	MONKLAND EGG GRADING	BLOSSOM	Normal/Brown
5580945012	BLOSSOM GRADE A LARGE BRO	12	MONKLAND EGG GRADING	BLOSSOM	Normal/Brown
5580945014	BLOSSOM FREE RUN LARGE 12S	12	MONKLAND EGG GRADING	BLOSSOM	**Free Run**
5580945015	BLOSSOM GRADE A LARGE	12	MONKLAND EGG GRADING	BLOSSOM	Normal
5580999000	BLOSSOM ALL NATURAL GRAIN FED	12	MONKLAND EGG GRADING	BLOSSOM	**Organic**
5580999180	BLOSSOM GRADE A LARGE 12S	12	MONKLAND EGG GRADING	BLOSSOM	Normal
5580999181	BLOSSOM GRADE A SMALL 18S (#99	18	MONKLAND EGG	BLOSSOM	Normal
5580999222	BLOSSOM DOUBLE YOLK EXTRA LARG	12	MONKLAND EGG GRADING	BLOSSOM	Normal
5580999333	BLOSSOM OMEGA 3 GRADE A LARGE	12	MONKLAND EGG GRADING	BLOSSOM	Omega 3

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5580999811	BLOSSOM GRADE A LARGE 8S (#9	8	MONKLAND EGG GRADING	BLOSSOM	Normal
5635220480	SUNSHINE FREE RANGE GRADE A BR	12	KING CONE ICE CREAM	SUNSHINE	Free Range
5635250100	SUNSHINE GRADE A BROWN LARGE 1	12	KING CONE ICE CREAM	SUNSHINE	Normal/Brown
5652600001	COUNTRY- SIDE GRADE A EX	12	COUNTRYSIDE FARMS	COUNTRY SIDE	Normal
5652600002	COUNTRY- SIDE GRADE A LAR	12	COUNTRYSIDE FARMS	COUNTRY SIDE	Normal
5652600003	COUNTRY- SIDE GRADE A MED	12	COUNTRYSIDE FARMS	COUNTRY SIDE	Normal
5652600004	COUNTRY- SIDE GRADE A SMA	12	COUNTRYSIDE FARMS	COUNTRY SIDE	Normal
5652600007	COUNTRY SIDE GRADE A LARGE FRE	12	COUNTRYSIDE FARMS	COUNTRY SIDE	Free Range
5652600200	COUNTRY SIDE GRADEA JUMBO 12S	12	COUNTRYSIDE FARMS	COUNTRY SIDE	Normal
5652600300	COUNTRY -SIDE GRADE A LAR	12	COUNTRYSIDE FARMS	COUNTRY SIDE	Normal
5652600520	COUNTRY SIDE GRADEA LARGE FAM	12	COUNTRYSIDE FARMS	COUNTRY SIDE	Normal
5652600600	COUNTRYSIDE GRADE A LARGE 6S	6	COUNTRYSIDE FARMS	COUNTRY SIDE	Normal
5652600800	COUNTRY- SIDE GRADE A LAR	12	COUNTRYSIDE FARMS	COUNTRY SIDE	Normal
5652605551	GERBERS GRADE A EXTRA LARGE 12	12	COUNTRYSIDE FARMS	GERBERS	Normal
5652605552	GERBERS GRADE A LARGE 12S	12	COUNTRYSIDE FARMS	GERBERS	Normal
5652605553	GERBERS GRADE A MEDIUM 12S	12	COUNTRYSIDE FARMS	GERBERS	Normal
5667212001	VEEKENS JUMBO GRADE A 12S	12	VEEKEN POULTRY FARM	VEEKEN	Normal
5667212002	VEEKEN GRADE A EX LARGE	12	VEEKEN POULTRY FARM	VEEKEN	Normal
5667212003	VEEKEN GRADE A LARGE	12	VEEKEN POULTRY FARM	VEEKEN	Normal
5667212004	VEEKENS GRADE A MEDIUM 12S (#1	12	VEEKEN POULTRY FARM	VEEKEN	Normal
5667212008	VEEKENS GRADE A EXTRA LARGEBRO	12	VEEKEN POULTRY FARM	VEEKEN	Normal/Brown
5667212013	VEEKENS FREE RANGEGRADE A LAR	12	VEEKEN POULTRY FARM	VEEKEN	Free Range
5667212022	VEEKENS FREE RANGE GRADE A EX	12	VEEKEN POULTRY FARM	VEEKEN	Free Range
5667212023	VEEKENS FREE RANGEGRADE A LARG	12	VEEKEN POULTRY FARM	VEEKEN	Free Range

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5667212033	VEEKEN OMEGA 3 GRADE A LARGE 1	12	VEEKEN POULTRY FARM	VEEKEN	Omega 3
5708811213	CHEF S CHOICE GRADE A LAR	12	O&T POULTRY FARMS	CHEFS CHOICE	Normal
5708811217	CHEF S CHOICE GRADE A LAR	12	O&T POULTRY FARMS	CHEFS CHOICE	Normal
5731602926	COUNTRY MORNING SMALL GRADE A	12	CONTROL LABEL	COUNTRY MORNING	Normal
5731602927	COUNTRY MORNING GRADE A MEDIUM	12	CONTROL LABEL	COUNTRY MORNING	Normal
5731602928	COUNTRY MORNING GRADE A LARGE	12	CONTROL LABEL	COUNTRY MORNING	Normal
5731607146	COUNTRY MORNING GRADE A EX LAR	12	CONTROL LABEL	COUNTRY MORNING	Normal
5731607625	COUNTRY MORNING GRADE A EX LAR	12	CONTROL LABEL	COUNTRY MORNING	Normal
5731607629	COUNTRY MORNING GRADE A X LRG	12	CONTROL LABEL	COUNTRY MORNING	Normal
5731607630	COUNTRY MORNING GRADE A LARGE	12	CONTROL LABEL	COUNTRY MORNING	Normal
5731608972	HARMONIE GRADE A LARGE WHITE 3	12	GENERIC LABEL	HARMONIE	Normal
5731609263	HARMONIE GENERIC GRADE A LARGE	12	GENERIC LABEL	HARMONIE	Normal
5731609373	COUNTRY MORNING GRADE A LARGE	12	CONTROL LABEL	COUNTRY MORNING	Normal
5731609375	COUNTRY MORNING GRADE A MEDIUM	12	CONTROL LABEL	COUNTRY MORNING	Normal
5731612111	HARMONIE GRADE A LARGE 18S	18	GENERIC LABEL	HARMONIE	Normal
5731612754	COUNTRY MORNING GRADE A EX LAR	12	CONTROL LABEL	COUNTRY MORNING	Normal
5762710114	EQUALITY GENERIC GRADE A MEDIU	12	GENERIC LABEL	EQUALITY	Normal
5762710116	MASTER CHOICE GRADE A LARGE12S	12	CONTROL LABEL	MASTER CHOICE	Normal
5762710704	SUNNY- FIELD GRADE A LAR	12	CONTROL LABEL	SUNNYFIELD	Normal
5762710708	SUNNY- FIELD GRADE A MED	12	CONTROL LABEL	SUNNYFIELD	Normal
5762710710	SUNNY- FIELD GRADE A SMA	12	CONTROL LABEL	SUNNYFIELD	Normal
5762710712	CANADAS CHOICE GRADE A SMA	12	CONTROL LABEL	CANADAS CHOICE	Normal
5762710714	EQUALITY GENERIC GRADE A	12	GENERIC LABEL	EQUALITY	Normal

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5762710716	A & P GRADE A LARGE	12	CONTROL LABEL	A&P	Normal
5762710718	CANADAS CHOICE GRADE A EX	12	CONTROL LABEL	CANADAS CHOICE	Normal
5762740714	MASTER CHOICE GRADE A MEDIUM 1	12	CONTROL LABEL	MASTER CHOICE	Normal
5768710114	MASTER CHOICE GRADE A MEDIUM 1	12	CONTROL LABEL	MASTER CHOICE	Normal
5768710116	EQUALITY GENERIC GRADE A LARGE	12	GENERIC LABEL	EQUALITY	Normal
5768710712	EGGS GRADE A LARGE12S (#10 712	12	UNBRANDED	UNBRANDED	Normal
5771101018	RICHARD FARMS GRADE A LARGE18S	18	PAUL RICHARD	RICHARD	Normal
5771101049	RICHARD FARM FRESHGRADE A LAR	12	PAUL RICHARD	RICHARD	Normal
5771101056	RICHARD FARMS GRADE A LARGE12S	12	PAUL RICHARD	RICHARD	Normal
5771101057	RICHARD FARMS GRADE A LARGE12S	12	PAUL RICHARD	RICHARD	Normal
5771101058	LE NOUVEL GRADE A LARGE 12S	12	PAUL RICHARD	LE NOUVEL	Normal
5771101064	RICHARD FARM FRESHGRADE A EXT	12	PAUL RICHARD	RICHARD	Normal
5771101256	RICHARD FARMS GRADE A LARGE6S	6	PAUL RICHARD	RICHARD	Normal
5771108056	RICHARD FARMS GRADE A LARGEBRO	12	PAUL RICHARD	RICHARD	Normal/Brown
5771108064	PAUL RICHARD GRADE A EXTRA LAR	12	FERME AVICOLE	PAUL RICHARD	Normal
5789330014	UNBRANDEDEX LARGE GRADE A	12	UNBRANDED	UNBRANDED	Normal
5789330024	UNBRANDED LARGE GRA	12	UNBRANDED	UNBRANDED	Normal
5789330031	MERCHANTSCNSLDATD GRADE A SMA	12	MERCHANTS CONSOL	MERCHANTS CNSLDATD	Normal
5789330034	UNBRANDED GRADE A MED	12	UNBRANDED	UNBRANDED	Normal
5789330044	UNBRANDED GRADE A SMA	12	UNBRANDED	UNBRANDED	Normal
5820000582	LUCERNE GRADE A LARGE WHITE6 S	12	CONTROL LABEL	LUCERNE	Normal
5820003175	LUCERNE GRADE A EXLARGE WH ITE	12	CONTROL LABEL	LUCERNE	Normal
5820003176	SNOWHITE GRADE A EX	12	?	SNO WHITE	Normal
5820003177	LUCERNE GRADE A EXLARGE WH ITE	12	CONTROL LABEL	LUCERNE	Normal
5820003187	MOUNTAIN BRAND GRADE A JUM	12	?	MOUNTAIN BRAND	Normal
5820003250	SAFEWAY GRADE A LARGE WHITE12S	12	CONTROL LABEL	SAFEWAY	Normal
5820003251	LUCERNE GRADE A LARGE BROWN12	12	CONTROL LABEL	LUCERNE	Normal/Brown
5820003252	SNO- WHITE EGGS LAR	12	?	SNO WHITE	Normal
5820003276	LUCERNE GRADE A MEDIUM BROWN 1	12	CONTROL LABEL	LUCERNE	Normal/Brown
5820003350	LUCERNE GRADE A MEDIUM WHITE 1	12	CONTROL LABEL	LUCERNE	Normal

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5820003351	SNOW WHITE MEDIUM GRA	12	?	SNO WHITE	Normal
5820003376	LUCERNE OAK GLEN GRADE B ASS S	12	CONTROL LABEL	LUCERNE	Normal(Grade B)
5820003450	LUCERNE GRADE A SMALL WHITE12	12	CONTROL LABEL	LUCERNE	Normal
5820003461	SAFEWAY GRADE A SELECT ORGANIC	12	CONTROL LABEL	SAFEWAY	Organic
5820003521	SAFEWAY GRADE A LARGE WHITE 1	12	CONTROL LABEL	SAFEWAY	Normal
5820003545	LUCERNE GRADE A PEE WEE WHITE	12	CONTROL LABEL	LUCERNE	Normal
5824120470	VANDER POLS FREE RANGE GRADE A	12	VANDERPOLS EGGS	VANDERPOLS	Free Range
5824120480	VANDER- POLS GRADE A BRW	12	VANDERPOLS EGGS	VANDERPOLS	Normal/Brown
5835500002	AVICOLE DU NORD GRADE A LAR	12	AVICOLE DU NORD	AVICOLE DU NORD	Normal
5835500014	AVICOLE DU NORD GRADE A EXTRA	12	AVICOLE DU NORD	AVICOLE DU NORD	Normal
5900101105	LARSEN GRADE A SMALL WHI	12	C&M ELLS	LARSEN	Normal
5900101112	LARSEN GRADE A EX LARGE WHI	12	C&M ELLS	LARSEN	Normal
5900101113	MIC MAC GRADE A LARGE WHI	12	C&M ELLS	MIC MAC	Normal
5900101114	MIC MAC GRADE A MEDIUM WHI	12	C&M ELLS	MIC MAC	Normal
5900101123	MIC MAC GRADE A LARGE BRO	12	C&M ELLS	MIC MAC	Normal/Brown
5900101124	LARSEN GRADE A MEDIUM	12	C&M ELLS	LARSEN	Normal
5900190102	EDEN VALLEY FARMS GRADE A EXTR	12	C&M ELLS	EDEN VALLEY FARMS	Normal
5900190104	EDEN VALLEY FARMS GRADE A JUMB	12	C&M ELLS	EDEN VALLEY FARMS	Normal
5900190117	EDEN VALLEY FARMS GRADE A LARG	12	C&M ELLS	EDEN VALLEY FARMS	Normal
5900190118	EDEN VALLEY FARMS GRADE A LARG	12	C&M ELLS	EDEN VALLEY FARMS	Normal
5900191140	EDEN VALLEY GRADE B LARGE 12 S	12	C&M ELLS	EDEN VALLEY FARMS	Normal (Grade B)
5900192117	EDEN VALLEY FREE RANGE GRADE A	12	C&M ELLS	EDEN VALLEY FARMS	Free Range
5900199016	EDEN VALLEY FARMS OMEGA 3 GRAD	12	C&M ELLS	EDEN VALLEY FARMS	Omega 3
5918100011	VILLE- TARDS GRADE A LAR	12	VILLETARDS EGGS	VILLETARDS	Normal

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5918100012	VILLE- TARDS GRADE A EX	12	VILLETARDS EGGS	VILLETARDS	Normal
5918100013	VILLE- TARDS GRADE A MED	12	VILLETARDS EGGS	VILLETARDS	Normal
5934812111	SIEUR DE MAISON NEUVE GRADEA J	12	GEORGE E VANDELAC	SIEUR DE MAISON NVE	Normal
5934812112	SIEUR DE MAISON- NEUVE GRA	12	GEORGE E VANDELAC	SIEUR DE MAISON NVE	Normal
5934812113	SIEUR DE MAISON- NEUVE GRA	12	GEORGE E VANDELAC	SIEUR DE MAISON NVE	Normal
5934812114	SIEUR DE MAISON- NEUVE GRA	12	GEORGE E VANDELAC	SIEUR DE MAISON NVE	Normal
5941800013	ROVAN GRADE A LARGE	12	ROVAN POULTRY FARMS	ROVAN	Normal
5970428293	T&S PAN- CHYSHYN GRADE A LAR	12	T&S PANCHYSHYN PLTRY	T&S PANCHYSHYN	Normal
5970428294	T&S PAN- CHYSHYN GRADE A MED	12	T&S PANCHYSHYN PLTRY	T&S PANCHYSHYN	Normal
5974905750	METRO GRADE A LARGE WHI	12	CONTROL LABEL	METRO	Normal
5974905784	METRO GRADE A MEDIUM WHI	12	CONTROL LABEL	METRO	Normal
5974912608	ECONOCHOIX WHITE GRADE A LARGE	12	CONTROL LABEL	ECONOCHOIX	Normal
5974912632	ECONOCHOIX GRADE A LARGE 12S(	12	CONTROL LABEL	ECONOCHOIX	Normal
5974912665	ECONOCHOIX GRADE A MEDIUM 12S	12	CONTROL LABEL	ECONOCHOIX	Normal
5974931160	SELECTIONMERITE G RADE A EXTRA	12	CONTROL LABEL	SELECTION MERITE	Normal
5974931178	SELECTIONMERITE G RADE A LARGE	12	CONTROL LABEL	SELECTION MERITE	Normal
5974931186	SELECTIONMERITE G RADE A MEDIU	12	CONTROL LABEL	SELECTION MERITE	Normal
5998978610	COALDALE GRADE A EX LARGE 12 S	12	COALDALE EGG FARMS	COALDALE	Normal
5998978620	COALDALE GRADE A LARGE 12 S	12	COALDALE EGG FARMS	COALDALE	Normal
5998978680	COALDALE GRADE A LARGE 12 S(#7	12	COALDALE EGG FARMS	COALDALE	Normal
6019633035	EGGS GRADE A SMALL	12	UNBRANDED	UNBRANDED	Normal
6022705280	IGA GENERIC EGGS GRADE A LARGE	12	GENERIC LABEL	I G A	Normal
6024902112	PROVIGO GENERIC GRADE A LARG	12	GENERIC LABEL	PROVIGO	Normal

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6024952122	GENERATION ZEL GENERIC GRADE A	12	GENERIC LABEL	GENERATION ZEL	Normal
6024952123	ZEL GENERIC GRADE A EXTRALAR	12	GENERIC LABEL	ZEL	Normal
6027900002	FERME RAYMOND GRADE A EX LARGE	12	BURNBRAE FARMS	LA FERME	Normal
6027900003	FERME RAYMOND GRADE A LAR	12	BURNBRAE FARMS	LA FERME	Normal
6038300894	SUNFRESH GENERIC GRADE A LAR	12	GENERIC LABEL	SUNFRESH	Normal
6038300941	SUNSPUN GRADE A MEDIUM 12 S	12	GENERIC LABEL	SUNSPUN	Normal
6038300942	SUNSPUN GRADE A LARGE	12	GENERIC LABEL	SUNSPUN	Normal
6038304998	SUPER- CENTRE GRADE A LAR	12	CONTROL LABEL	SUPERCENTRE	Normal
6038310931	SUNSPUN GRADE A LARGE 12	12	GENERIC LABEL	SUNSPUN	Normal
6038366413	SUNFRESH GENERIC GRADE A EXTRA	12	GENERIC LABEL	SUNFRESH	Normal
6038366414	SUNFRESH GENERIC GRADE A LARGE	12	GENERIC LABEL	SUNFRESH	Normal
6038366415	SUNFRESH GENERIC GRADE A MEDIU	12	GENERIC LABEL	SUNFRESH	Normal
6038366416	SUNFRESH GENERIC GRADE A SMALL	12	GENERIC LABEL	SUNFRESH	Normal
6038366417	SUNFRESH GENERIC GRADE A LARGE	12	GENERIC LABEL	SUNFRESH	Normal
6038367415	SUNFRESH GENERIC GRADE A EXTRA	12	GENERIC LABEL	SUNFRESH	Normal
6038367416	SUNFRESH GENERIC GRADE A LARGE	12	GENERIC LABEL	SUNFRESH	Normal
6038367417	SUNFRESH GENERIC GRADE A MEDIU	12	GENERIC LABEL	SUNFRESH	Normal
6038369068	PRESIDENTS CHOICE ORGANICS GRA	12	CONTROL LABEL	PRESIDENTS CHOICE	Organic
6038369069	PRESIDENTS CHOICE ORGANICS GRA	12	CONTROL LABEL	PRESIDENTS CHOICE	**Organic**
6038369427	PRESIDENTS CHOICE FREE RANGE G	12	CONTROL LABEL	PRESIDENTS CHOICE	Free Range
6038369503	PRESIDENTS CHOCE FREE RNGE GRA	12	CONTROL LABEL	PRESIDENTS CHOICE	Free Range
6038369504	ZIGGYS PREMIUM GRADE A LARGE 1	12	CONTROL LABEL	ZIGGYS	Normal
6038370776	PRESIDENTS CHOICE ORGANICS GRA	12	CONTROL LABEL	PRESIDENTS CHOICE	Organic
6038370927	PRESIDENTS CHOICE ORGANIC MEDI	12	CONTROL LABEL	PRESIDENTS CHOICE	Organic
6038371709	SUNFRESH GENERIC GRADE A LGE B	12	GENERIC LABEL	SUNFRESH	N/A
6038374581	PRESIDENTS CHOICE BLUE MENU OM	12	CONTROL LABEL	PRESIDENTS CHOICE	**Omega 3**

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6038375010	PRESIDENTS CHOICE BLUE MENU OM	12	CONTROL LABEL	PRESIDENTS CHOICE	**Omega 3**
6058510281	SUNSET GRADEA LAR	12	SUNSET POULTRY FARM	SUNSET	Normal
6058510283	SUNSET GRADE A MED	12	SUNSET POULTRY FARM	SUNSET	Normal
6058510285	SUNSET GRADE A SMA	12	?	SUNSET	Normal
6069796927	ZEHRS GRADE A EX LARGE	12	CONTROL LABEL	ZEHRS	Normal
6106200800	VANDER WEES GRADE A LARGE 18S	18	VANDERWEES PLTRY FRM	VANDERWEES	Normal
6106207367	VANDER- WEES GRADE A LAR	12	VANDERWEES PLTRY FRM	VANDERWEES	Normal
6106208743	VANDER WEES GRADE A SMALL 12S		VANDERWEES PLTRY FRM	VANDERWEES	Normal
6106210638	VANDER WEES GRADE A MEDIUM 12S	12	VANDERWEES PLTRY FRM	VANDERWEES	Normal
6106222164	VANDER WEES GRADE A EXTRA LARG	12	VANDERWEES PLTRY FRM	VANDERWEES	Normal
6148380410	FOREMOST GRADE A EX LARGE 12S	12	GENERIC LABEL	FOREMOST	Normal
6148380415	FOREMOST GRADE A LARGE 12S	12	GENERIC LABEL	FOREMOST	Normal
6148380420	FOREMOST GRADE A MEDIUM 12S	12	GENERIC LABEL	FOREMOST	Normal
6158600010	EGGS GRADE A LARGEFREE RAN GE	12	UNBRANDED	UNBRANDED	Free Range
6158600020	EGGS GRADE A LARGEFREE RAN GE	12	UNBRANDED	UNBRANDED	Free Range
6158600030	EGGS GRADE A EXTRALARGE BR OWN	12	UNBRANDED	UNBRANDED	Free Range
6171901103	NUTRI GRADE A EX LARGE	12	PRO OEUF	NUTRI	Normal
6171901104	MIRAGE STHYACINTHEGRADE A EX	12	?	MIRAGE	St Hyacinthe
6171901105	MIRAGE STHYACINTH EGRADE A LGE	12	?	MIRAGE	Normal
6171901107	NUTRI GRADE A SMALL	12	PRO OEUF	NUTRI	Normal
6171901108	PRO OEUF GRADE A PEE WEE	12	PRO OEUF	PRO OEUF	Normal
6171901109	NUTRI GRADE A LARGE	12	PRO OEUF	NUTRI	Normal
6171901110	NUTRI GRADE A LARGE BRO	12	PRO OEUF	NUTRI	Normal/Brown
6171901120	NUTRI GRADE A EXTRA LARGE 12S	12	PRO OEUF	NUTRI	Normal
6171901121	NUTRI GRADE A LARGE 12S	12	PRO OEUF	NUTRI	Normal

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6171901122	NUTRI GRADE A MEDIUM 12S (#011	12	PRO OEUF	NUTRI	Normal
6171901127	NUTRI OMEGA GRADE A LARGE 12S	12	PRO OEUF	NUTRI	Omega 3
6171901140	NUTRI GRADE A LARGE	12	PRO OEUF	NUTRI	Normal
6171901141	NUTRI ORGANIC GRADE A MEDIUM 1	12	PRO OEUF	NUTRI	Organic
6171901142	NUTRI GRADE A BROWN 8S	8	PRO OEUF	NUTRI	Normal/Brown
6171901154	NUTRI OMEGA 3 GRADE A LARGE6S	6	PRO OEUF	NUTRI	Omega 3
6171901155	PRO OEUF GRADE A LARGE 18S (#0	18	PRO OEUF	PRO OEUF	Normal
6171901159	NUTRI-OEUFS INC LIGHT GRADEA L	12	PRO OEUF	NUTRI	Normal
6171901161	NUTRI GRADE A EX LARGE 12S	12	PRO OEUF	NUTRI	Normal
6171901164	NUTRI OEUF GRADE ALARGE 30 S	30	PRO OEUF	NUTRI	Normal
6171901169	NUTRI SELECT GRADEA LARGE 12S	12	PRO OEUF	NUTRI	Normal
6171901176	NUTRI ORGANIC BROWN GRADE A LA	12	PRO OEUF	NUTRI	Organic/Brown
6180912345	SUNNY GLEN GRADE A EX	12	SUNNY GLEN EGGS	SUNNY GLEN	Normal
6180923456	SUNNY GLEN GRADE A LAR	12	SUNNY GLEN EGGS	SUNNY GLEN	Normal
6180934567	SUNNY GLEN GRADE A LRG	12	SUNNY GLEN EGGS	SUNNY GLEN	Normal
6180945678	SUNNY GLEN GRADE A MED	12	SUNNY GLEN EGGS	SUNNY GLEN	Normal
6192500401	SOBEYS GRADE A SMALL WHITE 1	12	CONTROL LABEL	SOBEYS	Normal
6192500402	SOBEYS GRADE A MEDIUM WHITE	12	CONTROL LABEL	SOBEYS	Normal
6192500403	SOBEYS GRADE A LARGE WHITE 1	12	CONTROL LABEL	SOBEYS	Normal
6192500404	SOBEYS GRADE A EX LARGE WHIT	12	CONTROL LABEL	SOBEYS	Normal
6192500405	SOBEYS GRADE A LARGE BROWN 1	12	CONTROL LABEL	SOBEYS	Normal/Brown
6192500406	SOBEYS GRADE A MEDIUM BROWN	12	CONTROL LABEL	SOBEYS	Normal/Brown
6192570390	SOBEYS GRADE A EX LARGE BROW	12	CONTROL LABEL	SOBEYS	Normal/Brown
6220901005	AUIBRO GRADE A LARGE BROWN 6S	6	AVIBRO	AVIBRO	Normal/Brown
6220901018	AVIBRO GRADE A LARGE 18S	18	AVIBRO	AVIBRO	Normal
6220901104	AUIBRO GRADE A EX LARGE	12	AVIBRO	AVIBRO	Normal
6220901105	AUIBRO GRADE A LARGE BRO	12	AVIBRO	AVIBRO	Normal/Brown
6220901106	AUIBRO GRADE A MEDIUM	12	AVIBRO	AVIBRO	Normal
6220901107	AUIBRO GRADE A SMALL	12	AVIBRO	AVIBRO	Normal
6220901108	AVIBRO EGGS GRADE A EX LARGE 1	12	AVIBRO	AVIBRO	Normal
6220901205	EGGS GRADE A LARGE	12	UNBRANDED	UNBRANDED	Normal
6220901505	AUIBRO GRADE A LARGE BROWN 6S	6	AVIBRO	AVIBRO	Normal/Brown

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6220902305	AUIBRO GRADE A LARGE	12	AVIBRO	AVIBRO	Normal
6220902306	AVIBRO GRADE A LARGE OMEGA 3 1	12	AVIBRO	AVIBRO	Omega 3
6220902505	AVIBRO GRADE A LARGE BROWN 12S	12	AVIBRO	AVIBRO	Normal/Brown
6220902605	AVIBRO GRADE A LARGE 12S (#026	12	AVIBRO	AVIBRO	Normal
6220902705	AVIBRO 10 VITAMINS GRADE A LAR	12	AVIBRO	AVIBRO	**Vitamin Enhanced**
6220902804	AVIBRO FREE RANGE GRADE A LARG	12	AVIBRO	AVIBRO	Free Range
6220902805	AVIBRO GRADE A LARGE 8S	8	AVIBRO	AVIBRO	Normal
6220903005	AVIBRO GRADE A LARGE 30S	30	AVIBRO	AVIBRO	Normal
6220907104	AVIBRO GRADE A EXTRA LARGE BRO	12	AVIBRO	AVIBRO	Normal/Brown
6220907200	AVIBRO GRADE A LARGE 12S	12	AVIBRO	AVIBRO	Normal
6220907304	AUIBRO GRADE A JUMBO	12	AVIBRO	AVIBRO	Normal
6220907404	AVRIBO GRADE A LARGE 30S	30	AVIBRO	AVIBRO	Normal
6221021211	COX BROTHERS GRADE A EX	12	COX BROTHERS	COX BROTHERS	Normal
6221021212	COX BROS GRADE A LARGE WHITE 1	12	COX BROTHERS	COX BROTHERS	Normal
6232537019	ORGANIC MEADOW ORGANIC GRADE A	12	?	ORGANIC MEADOW	Organic
6232537021	ORGANIC MEADOW GRADE A LARGE 1	12	?	ORGANIC MEADOW	**Organic**
6232537023	ORGANIC MEADOW GRADE A EX LARG	12	?	ORGANIC MEADOW	**Organic**
6259100020	EGGS GRADE A EX LARGE 12S (#00	12	UNBRANDED	UNBRANDED	**Organic**
6259100030	BURNS PTRY & CHKN HATCHERY GRA	12	BURNS POULTRY	BURNS	Normal
6259100031	BURNS PTRY & CHKN HATCHERY GRA	12	BURNS POULTRY	BURNS	Normal
6259100034	BURNS PTRY&CHKNHATCHERY GRA	12	BURNS POULTRY	BURNS	Normal
6259100040	BURNS PTRY&CHKN HATCHERY GRADE	12	BURNS POULTRY	BURNS	Normal
6260950050	SUPER C GRADE A SMALL 12	12	CONTROL LABEL	SUPER C	Normal
6260950051	SUPER C GRADE A MEDIUM	12	CONTROL LABEL	SUPER C	Normal
6260950052	SUPER C GRADE A LARGE	12	CONTROL LABEL	SUPER C	Normal
6260950053	SUPER C GRADE A EX LARGE	12	CONTROL LABEL	SUPER C	Normal
6263918628	WESTERN FAMILY GRADE A LARGE E	12	CONTROL LABEL	WESTERN FAMILY	Normal
6263918629	WESTERN FAMILY GRADE A SMALL 3	12	CONTROL LABEL	WESTERN FAMILY	Normal

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6263918630	WESTERN FAMILY GRADE A MEDIUM	12	CONTROL LABEL	WESTERN FAMILY	Normal
6263919971	WESTERN FAMILY GRADE A LARGE 4	12	CONTROL LABEL	WESTERN FAMILY	Normal
6263919978	WESTERN FAMILY GRADE A LARGE 1	12	CONTROL LABEL	WESTERN FAMILY	Normal
6263941011	WESTERN FAMILY GRADE A EXLRG 1	12	CONTROL LABEL	WESTERN FAMILY	Normal
6263941012	WESTERN FAMILY GRADE A LRG 12	12	CONTROL LABEL	WESTERN FAMILY	Normal
6263941013	WESTERN FAMILY GRADE A MED 12S	12	CONTROL LABEL	WESTERN FAMILY	Normal
6263941014	WESTERN FAMILYGRADE A SMALL12S	12	CONTROL LABEL	WESTERN FAMILY	Normal
6263941044	OVERWAITEA GRADE ALARGE 12 S (	12	CONTROL LABEL	OVERWAITEA	Normal
6263941157	WESTERN FAMILY GRADE A LRGBRO	12	CONTROL LABEL	WESTERN FAMILY	Normal/Brown
6289212344	EGGS GRADE A LARGE	12	UNBRANDED	UNBRANDED	Normal
6390200200	STAR EGG GRADE A X LARGE WHI	12	STAR EGG	STAR EGG	Normal
6390200201	STAR EGG GRADE A LARGE WHI	12	STAR EGG	STAR EGG	Normal
6390200202	STAR EGG GRADE A MEDIUM WHI	12	STAR EGG	STAR EGG	Normal
6390200203	STAR EGG GRADE A SMALL WHI	12	STAR EGG	STAR EGG	Normal
6390200205	HARMAN GRADE A JUMBO 12S	12	STAR EGG	HARMAN	Normal
6390200211	HARMAN GRADE A LARGE 12S	12	STAR EGG	HARMAN	Normal
6390200600	EGGS GRADE A LARGE	12	UNBRANDED	UNBRANDED	Normal
6390200700	STAR EGG FREE RANGE GRADE A LA	12	STAR EGG	STAR EGG	Free Range
6390204030	STAR EGG GRADE A X LARGE WHI	12	STAR EGG	STAR EGG	Normal
6404400101	AVG GRADEA EX	12	FOUR D RANCH	AVG	Normal
6404400102	AVG GRADE A LAR	12	FOUR D RANCH	AVG	Normal
6404400103	AVG GRADE A MED	12	FOUR D RANCH	AVG	Normal
6476703122	GRAY JUST EGG WHITES 250 ML		L H GRAY&SON	GRAY	Processed
6476703124	GRAY JUST EGG WHITES 500 ML		L H GRAY&SON	GRAY	Processed
6476703126	GRAY JUST EGG WHITES 3 X 500ML		L H GRAY&SON	GRAY	Processed
6476734100	GRAY RIDGE 747 GRADE A EX LG W	12	L H GRAY&SON	GRAY RIDGE	Normal
6476734200	GRAY RDGEMUSKOKA GRADE A EX	12	L H GRAY&SON	GRAY RIDGE	Normal
6476734201	GRAY RIDGE EXTRA LARGE BROWN 1	12	L H GRAY&SON	GRAY RIDGE	Normal/Brown
6476734205	GRAY RIDGE EX LARGE WHI	12	L H GRAY&SON	GRAY RIDGE	Normal
6476734209	CONESTOGAGRADE A EX LARGE FRE	12	L H GRAY&SON	CONESTOGA	Free Range
6476734225	CONESTOGAORGANIC GRADE A EX L	12	L H GRAY&SON	CONESTOGA	Organic
6476734300	GRAY RDGEMUSKOKA GRADE CRA	12	L H GRAY&SON	GRAY RIDGE	Normal

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6476734301	BROWNIE GRADE A LARGE BROWN12	12	L H GRAY&SON	BROWNIE	Normal/Brown
6476734302	CONESTOGAGRADE A LARGE	12	L H GRAY&SON	CONESTOGA	Normal
6476734304	GRAY RIDGE PREMIUM GRADE A LAR	12	L H GRAY&SON	GRAY RIDGE	Normal
6476734305	GRAY RIDGE GRADE ALARGE 12 S (	12	L H GRAY&SON	GRAY RIDGE	Normal
6476734306	GRAY RIDGE HEALTHY NATURAL GRA	12	L H GRAY&SON	GRAY RIDGE	**Organic**
6476734307	GRAY RIDGE OMEGA 3LOW FAT GRA	12	L H GRAY&SON	GRAY RIDGE	Omega 3
6476734308	GRAY RIDGE GRADE A LARGE DOUBL	12	L H GRAY&SON	GRAY RIDGE	Normal
6476734310	GRAY RIDGE GRADE ALARGE FR EE	12	L H GRAY&SON	GRAY RIDGE	Free Range
6476734311	GRAY RIDGE GRADE ABROWN L ARG	12	L H GRAY&SON	GRAY RIDGE	Normal/Brown
6476734321	GRAY RIDGE OMEGA NAT BRAND GRA	12	L H GRAY&SON	GRAY RIDGE	Omega 3
6476734325	CONESTOGAORGANIC GRADE A LARG	12	L H GRAY&SON	CONESTOGA	Organic
6476734340	L H GRAY MY T FRESH OMEGA 3 GR	12	L H GRAY&SON	L H GRAY	Omega 3
6476734400	CONESTOGAGRADE A MEDIUM	12	L H GRAY&SON	CONESTOGA	Normal
6476734500	CONESTOGAGRADE A SMALL	12	L H GRAY&SON	CONESTOGA	Normal
6476734600	GRAY RIDGE GRADE A PEE	12	L H GRAY&SON	GRAY RIDGE	Normal
6476744350	GRADE RIDGE GRADE A LARGE 18S	18	L H GRAY&SON	GRAY RIDGE	Normal
6551200490	WEST BESTGRADE A LARGE 12S(#0	12	WESTERN ALBERTA PROD	WEST BEST	Normal
6551201098	WEST BESTGRADE A LARGE BROWN	12	WESTERN ALBERTA PROD	WEST BEST	Normal/Brown
6554000007	THE BEST UV ALL GRADE A LARGE	12	AARON METZGER	BEST UV ALL	Normal
6554000008	AARON METZGER GRADE A MEDIUM B	12	AARON METZGER	METZGER	Normal/Brown
6554000012	BEST UV ALL GRADE A PEE	12	AARON METZGER	BEST UV ALL	Normal
6554000015	FIRST CHOICE GRADE A LAR	12	AARON METZGER	FIRST CHOICE	Normal
6565100001	BURNBRAE FARMS LARGE 18 S	18	BURNBRAE FARMS	BURNBRAE FARMS	Normal
6565100002	BURNBRAE FARMS GRADE A LAR	12	BURNBRAE FARMS	BURNBRAE FARMS	Normal
6565100003	BON EE BEST GRADE A MED	12	BURNBRAE FARMS	BON EE BEST	Normal
6565100004	BON EE BEST GRADE A SMA	12	BURNBRAE FARMS	BON EE BEST	Normal
6565100005	BON EE BEST GRADE A EX	12	BURNBRAE FARMS	BON EE BEST	Normal
6565100006	BURNBRAE GRADE A PEE WEE 12S (	12	BURNBRAE FARMS	BURNBRAE FARMS	Normal

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6565100008	BON EE BEST GRADE A JUM	12	BURNBRAE FARMS	BON EE BEST	Normal
6565100011	BURNBRAE FARMS GRADE A EX	12	BURNBRAE FARMS	BURNBRAE FARMS	Normal
6565100012	BON EE BEST GRADE A LAR	12	BURNBRAE FARMS	BON EE BEST	Normal
6565100014	BONEE BEST GRADE AEXTRA LA RGE	12	BURNBRAE FARMS	BON EE BEST	Normal
6565100015	PRESTIGE GRADE A LARGE	12	BURNBRAE FARMS	PRESTIGE	Normal
6565100016	BURNBRAE GRADE A LARGE 6S	6	BURNBRAE FARMS	BURNBRAE FARMS	Normal
6565100018	BON EE BEST GRADE A DOU	12	BURNBRAE FARMS	BON EE BEST	Normal
6565100019	PRESTIGE GRADE A LARGE	12	BURNBRAE FARMS	PRESTIGE	Normal
6565100021	BON EE BEST GRADE A LAR	12	BURNBRAE FARMS	BON EE BEST	Normal
6565100022	NATURE BEST GRADE A LAR	12	BURNBRAE FARMS	NATURES BEST	Vitamin Enhanced
6565100023	BON EE BEST NATUREGG GRADE A L	12	BURNBRAE FARMS	BON EE BEST	Normal
6565100025	FERME ST ZOTIQUE BROWN GRA	12	BURNBRAE FARMS	FERME ST ZOTIQUE	Normal/Brown
6565100027	EGGS GRADE A JUMBO	12	UNBRANDED	UNBRANDED	Normal
6565100029	BURNBRAE LARGE LOOSE EGGS 7.5	12	BURNBRAE FARMS	BURNBRAE FARMS	Normal
6565100053	BONEE BEST NUTREGGOMEGA 3 W/V	12	BURNBRAE FARMS	BON EE BEST	Omega 3
6565100059	BONEE BEST OMEGA 3NATUREGG GRA	12	BURNBRAE FARMS	BON EE BEST	Omega 3
6565100076	BURNBRAE GRADE A LARGE 6S(#000	6	BURNBRAE FARMS	BURNBRAE FARMS	Normal
6565100095	BON EE BEST NUTREGG OMEGA 3GRA	12	BURNBRAE FARMS	BON EE BEST	Omega 3
6565100118	BURNBRAE GRADE A PEEWEE 30S	30	BURNBRAE FARMS	BURNBRAE FARMS	Normal
6565100120	BURNBRAE GRADE A EXTRA LARGE 3	12	BURNBRAE FARMS	BURNBRAE FARMS	Normal
6565100152	NATUREGG 100% PURE EGG WHITES		BURNBRAE FARMS	NATUREGG	**Processed**
6565100156	NATUREGG BREAK FREE LIQUID EGG		BURNBRAE FARMS	NATUREGG	**Processed**
6565100157	BURNBRAE NATUR EGG GRADE A LAR	12	BURNBRAE FARMS	BURNBRAE FARMS	Normal
6565100221	BURNBRAE FARMS ORGANIC GRADE A	12	BURNBRAE FARMS	BURNBRAE FARMS	Organic

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6565100232	BURNBRAE FARMS FREE RANGE NATU	12	BURNBRAE FARMS	BURNBRAE FARMS	Free Range
6565100233	NATUREGG OMEGA PRO LIQUID EGG		BURNBRAE FARMS	NATUREGG	**Processed**
6565100249	NATUREGG SIMPLY EGG WHITES LIQ		BURNBRAE FARMS	NATUREGG	**Processed**
6565100261	BURNBRAE FARMS OMEGA 3 GRADE A	12	BURNBRAE FARMS	BURNBRAE FARMS	Omega 3
6565100267	BURNBRAE FARMS ORGANIC GRADE A	12	BURNBRAE FARMS	BURNBRAE FARMS	Organic
6565100269	BURNBRAE NATURE FREE GRADE A M	12	BURNBRAE FARMS	BURNBRAE FARMS	**Free Range**
6565100292	NATUREGG EGG WHITES 2X500ML		BURNBRAE FARMS	NATUREGG	**Processed**
6565100326	BURNBRAE FARMS OMEGA 3 LARGE B	12	BURNBRAE FARMS	BURNBRAE FARMS	Omega 3
6565100328	BURNBRAE FARMS GRADE A LARGE	12	BURNBRAE FARMS	BURNBRAE FARMS	Normal
6565100329	NATUREGG LIQUID EGG PRODUCT BR		BURNBRAE FARMS	NATUREGG	**Processed**
6565700001	PRESTIGE GRADE A MEDIUM BROWN	12	BURNBRAE FARMS	PRESTIGE	Normal
6565700015	PRESTIGE GRADE A MEDIUM 12S	12	BURNBRAE FARMS	PRESTIGE	Normal
6626900101	SULLYS GRADE A EXTRA LARGE 12S	12	?	SULLYS	Normal
6626900102	SULLYS GRADE A LARGE	12	?	SULLYS	Normal
6626900103	SULLYS GRADE A MEDIUM	12	?	SULLYS	Normal
6626900104	SULLYS GRADE A SMALL	12	?	SULLYS	Normal
6635100001	MOUNTAIN VIEW GRADE A EX	12	MOUNTAIN VIEW FARMS	MOUNTAIN VIEW	Normal
6635100002	EGGS GRADE A LARGE	12	UNBRANDED	UNBRANDED	Normal
6635100004	EGGS GRADE A LARGE	12	UNBRANDED	UNBRANDED	Normal
6635100005	MOUNTAIN VIEW GRADE A LRG	12	MOUNTAIN VIEW FARMS	MOUNTAIN VIEW	Normal
6635100009	MOUNTAIN VIEW GRADE A LAR	12	MOUNTAIN VIEW FARMS	MOUNTAIN VIEW	Normal
6635100020	MOUNTAIN VIEW FREERANGE GR ADE	12	MOUNTAIN VIEW FARMS	MOUNTAIN VIEW	Free Range
6655800123	UNBRANDEDGRADE A EXTRA LARGE	12	UNBRANDED	UNBRANDED	Normal

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6655800234	UNBRANDEDGRADE A LARGE 12S(#0	12	UNBRANDED	UNBRANDED	Normal
6665200102	OLERA FARMS ORGANIC GRADE A SM	12	?	OLERA FARMS	Organic
6665211001	OLERA FARMS ORGANIC GRADE ALAR	12	?	OLERA FARMS	Organic
6665211639	OLERA FARMS ORGANIC GRADE A EX	12	?	OLERA FARMS	Organic
6665219638	OLERA FARMS ORGANIC GRADE AMED	12	?	OLERA FARMS	Organic
6669700002	EGGS GRADE A LARGE	12	UNBRANDED	UNBRANDED	Normal
6693303597	CANADIAN HARVEST GRADE A LARGE	12	C S P FOODS	CANADIAN HARVEST	Normal
6693400020	HUNTER GRADE A MEDIUM	12	HUNTERS POULTRY FARM	HUNTER	Normal
6693400030	HUNTER GRADE A LARGE	12	HUNTERS POULTRY FARM	HUNTER	Normal
6693400040	HUNTER GRADE A EX LARGE	12	HUNTERS POULTRY FARM	HUNTER	Normal
6693906000	AVALON ORGANIC CERTIFIED GRADE	12	AVALON DAIRIES	AVALON	Organic
6693906001	AVALON ORGANIC GRADE A LARGE 1	12	AVALON DAIRIES	AVALON	Organic
6693906002	AVALON ORGANIC GRADE A EXTRA L	12	AVALON DAIRIES	AVALON	Organic
6694290042	BORN 3 OMEGA LOW FAT GRADE A	12	SHAFER HAGGART	BORN 3	Omega 3
6768500100	MARCHE D ALIMENTS GRADE A X L	12	REAL VEER	MARCHE D ALIMENTS	Normal
6768500101	MARCHE D ALIMENTS GRADE A LAR	12	MARCHE D ALIMENTS	MARCHE D ALIMENTS	Normal
6768500102	MARCHE D ALIMENTS GRADE A MED	12	MARCHE D ALIMENTS	MARCHE D ALIMENTS	Normal
6779901005	NEW BRUNSWICK CHOICE GRADE A B	12	RIVERSIDE POULTRY	NEW BRUNSWICK	Normal/Brown
6779901791	NEW BRUNSWICK GRADE A LARGE 12	12	RIVERSIDE POULTRY	NEW BRUNSWICK	Normal
6779907190	UNBRANDEDGRADE A EXTRA LARGE	12	UNBRANDED	UNBRANDED	Normal
6779907191	UNBRANDEDGRADE A LARGE 12S(#0	12	UNBRANDED	UNBRANDED	Normal
6779907192	UNBRANDEDGRADE A MEDIUM 12S (	12	UNBRANDED	UNBRANDED	Normal
6779907200	NEW BRUNSWICK CHOICE NURSERY G	12	RIVERSIDE POULTRY	NEW BRUNSWICK	Normal
6779908006	NEW BRUNSWICK CHOICE GRADE A L	12	RIVERSIDE POULTRY	NEW BRUNSWICK	Normal
6779908104	NEW BRUNSWICK CHOICE ULTRA GRA	12	RIVERSIDE POULTRY	NEW BRUNSWICK	**Organic**
6779908112	NEW BRUNSWICK CHOICE ALL GRAIN	12	RIVERSIDE POULTRY	NEW BRUNSWICK	**Organic**

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6779908118	NEW BRUNSWICK CHOICE GRADE A L	12	RIVERSIDE POULTRY	NEW BRUNSWICK	Normal
6779908304	NEW BRUNSWICK CHOICE GRADE A J	12	RIVERSIDE POULTRY	NEW BRUNSWICK	Normal
6779908305	NEW BRUNSWICK CHOICE OMEGA 3 G	12	RIVERSIDE POULTRY	NEW BRUNSWICK	Omega 3
6796200002	LA FERME MORIN GRADE A MED	12	FERME AVICOLE	LA FERME MORIN	Normal
6796200021	LA FERME MORIN GRADE A LARGE B	12	FERME AVICOLE	LA FERME MORIN	Normal
6798310001	SPARKS FARM GRADE A EX	12	GILANI	SPARKS FARM	Normal/Brown
6798310002	SPARKS FARM GRADE A LAR	12	GILANI	SPARKS FARM	Normal
6798310003	WESTERN FAMILY GRADE A MEDIUM	12	CONTROL LABEL	WESTERN FAMILY	Normal
6798310005	LILYDALE GRADE A LARGE WHITE 6	6	ALBERTA EGGS	LILYDALE	Normal/Brown
6798310006	LILYDALE GRADE A LARGE BROWN C	12	ALBERTA EGGS	LILYDALE	Normal/Brown
6798310008	LILYDALE GRADE A LARGE BROWN 3	12	ALBERTA EGGS	LILYDALE	Normal
6798310010	LILYDALE FORMULA 3GRADE A LAR	12	ALBERTA EGGS	LILYDALE	**Omega 3**
6798310012	LILYDALE GRADE A LARGE 12S BRO	12	ALBERTA EGGS	LILYDALE	Normal
6798310013	LILYDALE GRADE A LARGE BROWN 1	12	ALBERTA EGGS	LILYDALE	Normal/Brown
6798310020	EGGS GRADE A LARGE30S (#10 020	30	UNBRANDED	UNBRANDED	Normal
6798315000	LILYDALE GRADE A LARGE 18S	18	ALBERTA EGGS	LILYDALE	Normal
6798315001	LILYDALE OMEGA FORMULA 3GRADE	12	ALBERTA EGGS	LILYDALE	Omega 3
6798315002	LILYDALE FREE RANGE GRADE A LA	12	ALBERTA EGGS	LILYDALE	Free Range
6798315004	LILYDALE NUTRA RICH EGGS GRADE	12	ALBERTA EGGS	LILYDALE	Normal
6802700007	SUNSHINE GRADE A JUMBO 12S	12	DAYBREAK FARMS	SUNSHINE	Normal
6802710111	COOPERS GRADE A EXTRA LARGE12S	12	CONTROL LABEL	COOPERS	Normal
6802710113	WESTERN FAMILY GRADE A LARGE W	12	CONTROL LABEL	WESTERN FAMILY	Normal
6802710115	COOPER GRADE A MEDIUM 12 S (C.	12	CONTROL LABEL	COOPERS	Normal
6802710117	COOPERS GRADE A SMALL 12S (CL)	12	CONTROL LABEL	COOPERS	Normal
6802710119	COOPERS GRADE A LARGE 18S (CL)	18	CONTROL LABEL	COOPERS	Normal
6808200001	GRAND VALLEY GRADE A EX	12	GRAND VALLEY EGGS	GRAND VALLEY	Normal
6808200002	GRAND VALLEY GRADE A LAR	12	GRAND VALLEY EGGS	GRAND VALLEY	Normal
6808200003	GRAND VALLEY GRADE A MED	12	GRAND VALLEY EGGS	GRAND VALLEY	Normal
6808200004	GRAND VALLEY GRADE A SMA	12	GRAND VALLEY EGGS	GRAND VALLEY	Normal
6808200005	GRAND VALLEY GRADE A LARGE 18S	12	GRAND VALLEY EGGS	GRAND VALLEY	Normal
6825800100	SPARKS FARM PEE WEE GRA	12	GILANI	SPARKS FARM	**Organic**
6825800120	SPARKS FARM PEE WEE GRA	12	GILANI	SPARKS FARM	**Organic**

UPC	UPC Description	# of Eggs	Manufacturer Description	Brand Description	Sub Brand Description
6825800130	FOOD CITY MEDIUM GRA	12	CONTROL LABEL	FOOD CITY	**Organic**
6825800140	FOOD CITY LARGE GRA	12	CONTROL LABEL	FOOD CITY	**Organic**
6825800141	SPARK FARM GRADE A LAR	12	GILANI	SPARKS FARM	Normal
6825800150	FOOD CITY X LARGE GRA	12	CONTROL LABEL	FOOD CITY	**Organic**
6825800240	SPARKS FARM GRADE A BRO	12	GILANI	SPARKS FARM	Normal/Brown
6825800900	SPARKS FARM GRADE A EX LARGE 1	12	GILANI	SPARKS FARM	Normal
6825800925	CO-OP GRADE A LARGE 6 S	6	CONTROL LABEL	CO OP	Normal
6825800950	SPARKS FARM GRADE A LAR	12	GILANI	SPARKS FARM	Normal
6825800976	SPARKS FARMS GRADE A LAR	12	GILANI	SPARKS FARM	Normal
6825801839	SPARKS FARM GRADE A MEDIUM FRE	12	GILANI	SPARKS FARM	Free Range
6825861820	SPARKS NUTRI OMEGA3 GRADE A L	12	GILANI	SPARKS FARM	Omega 3
6825861830	SPARKS GRAIN FED GRADE A LARGE	12	GILANI	SPARKS FARM	**Organic**
6825861840	SPARKS FARM ORGANIC GRADEA EX	12	GILANI	SPARKS FARM	Organic
6825861850	SPARKS ORGANIC FEED GRADE A LA	12	GILANI	SPARKS FARM	Organic
6825861860	SPARKS FARM FINEST GRADE A LAR	12	GILANI	SPARKS FARM	normal
6835000001	MASTER HUMPTY GRADE A EX	12	MASTERS POULTRY FARM	MASTER HUMPTY	Normal
6835000003	CALBECKS GRADE A LARGE	12	CONTROL LABEL	CALBECKS	Normal
6870099145	DAIRYLAND GRADE A LARGE 12S	12	SAPUTO	DAIRYLAND	Normal
6872901105	MORNEAULTGRADE A LARGE WHI	12	FERME MORNEAULT	MORNEAULT	Normal
6872901106	MORNEAULTGRADE A MEDIUM	12	FERME MORNEAULT	MORNEAULT	Normal
6872901108	EGGS GRADE A PEE WEE 12S (#011	12	UNBRANDED	UNBRANDED	Normal
6882000501	DUTCH BOYGRADE A LARGE WHITE 1	12	CONTROL LABEL	DUTCH BOY	Normal
6926100001	BRETON SUPER GRADE A EX	12	BRETON&CIE	BRETON	Normal
6926100002	BLAIS & BRETON GRADE A EX	12	BRETON&CIE	BLAIS&BRETON	Normal
6926100003	BRETON GRADE A LARGE	12	BRETON&CIE	BRETON	Normal
6926100004	BLAIS & BRETON GRADE A MED	12	BRETON&CIE	BLAIS&BRETON	Normal
6926100005	BRETON GRADE A SMALL	12	BRETON&CIE	BRETON	Normal
6926100006	BRETON GRADE A PEEWEE	12	BRETON&CIE	BRETON	Normal
6926100007	BRETON & CIE GRADEA LARGE WHI	6	BRETON&CIE	BRETON	Normal
6926100010	BRETON SUPER GRADE A EX	12	BRETON&CIE	BRETON	Normal
6926100011	BRETON GRADE A LARGE BRO	12	BRETON&CIE	BRETON	Normal/Brown

UPC	UPC Description	# of Eggs	Manufacturer Description	Brand Description	Sub Brand Description
6926100012	BRETON GRADE A MEDIUM BRO	12	BRETON&CIE	BRETON	Normal/Brown
6926100014	BRETON GRADE A LARGE 12 S	12	BRETON&CIE	BRETON	Normal
6926100015	BLAIS & BRETON GRADE A LAR	12	BRETON&CIE	BLAIS&BRETON	Normal
6926100016	BRETON & CIE GRADEA LARGE BROW	12	BRETON&CIE	BRETON	Normal/Brown
6926100017	BRETON GRADE A SMALL 18S	18	BRETON&CIE	BRETON	Normal
6926100018	BRETON GRADE A EXTRA LARGE DOU	12	BRETON&CIE	BRETON	Normal
6926100019	BRETON & CIE GRADEA LARGE 18S	18	BRETON&CIE	BRETON&CIE	Normal
6926100214	BRETON GRADE A LARGE6S	6	BRETON&CIE	BRETON	Normal
6926100215	BRETON GRADE A LARGE 8S	8	BRETON&CIE	BRETON	Normal
6926100216	BRETON GARDE A LARGE 12S (#002	12	BRETON&CIE	BRETON	Normal
6926100217	BRETON OMEGA 3 LARGE 12 S	12	BRETON&CIE	BRETON	Omega 3
6926100219	BRETON GRADE A MEDIUM 12S	12	BRETON&CIE	BRETON	Normal
6948103120	VANDERPOLS EGG WHITES 2 KG		VANDERPOLS EGGS	VANDERPOLS	Processed
6948103124	VANDERPOLS JUST EGG WHITES 50	12	?	VANDERPOLS	Processed
6964900002	REAL VEERGRADE A SMALL	12	REAL VEER	REAL VEER	Normal
6964900003	REAL VEERGRADE A MEDIUM 12S	12	REAL VEER	REAL VEER	Normal
6964900004	REAL VEER GRADE A LARGE 12S (#	12	REAL VEER	REAL VEER	Normal
6964900010	REAL VEER GRADE A LAR	12	REAL VEER	REAL VEER	Normal
6964900015	REAL VEERGRADE A LARGE 12S	12	REAL VEER	REAL VEER	Normal
6964900016	REAL VEERGRADE A EXTRA LARGE	12	REAL VEER	REAL VEER	Normal
6964900050	REAL VEERGRADE A JUMBO 12S	12	REAL VEER	REAL VEER	Normal
6964900055	EGGS GRADE A LARGE 18S (#00055	18	UNBRANDED	UNBRANDED	Normal
6964900100	MATINELLEGRADE A LARGE	12	REAL VEER	MATINELLE	Normal
6964900101	MATINELLEGRADE A LARGE	12	REAL VEER	MATINELLE	Normal
6964901000	REAL VEER LES JOY GRADE A LARG	12	REAL VEER	REAL VEER	Normal
6964901002	REAL VEERLES JOY GRADE A JUMB	12	REAL VEER	REAL VEER	Normal
6995900001	ISLAND GOLD GRADE A X L	12	ISLAND EGGS	ISLAND GOLD	Normal
6995900002	ISLAND GOLD LARGE GRA	12	ISLAND EGGS	ISLAND GOLD	Normal
6995900003	ISLAND GOLD GRADE A MED	12	ISLAND EGGS	ISLAND GOLD	Normal
6995900004	ISLAND GOLD GRADE A SMA	12	ISLAND EGGS	ISLAND GOLD	Normal
6995900020	ISLAND GOLD GRADE A LAR	12	ISLAND EGGS	ISLAND GOLD	Normal
7000414403	MARITIME PRIDE OMEGA 3 GRADE A	12	ARCHIBALD FARMS	MARITIME PRIDE	Omega 3

UPC	UPC Description	# of Eggs	Manufacturer Description	Brand Description	Sub Brand Description
7000414408	MARITIME PRIDE GRADE A LARGE 1	12	ARCHIBALD FARMS	MARITIME PRIDE	Normal
7000414418	MARITIME PRIDE GRADE A EXTRA L	12	ARCHIBALD FARMS	MARITIME PRIDE	Normal
7000414428	MARITIME PRIDE FREE RANGE GRAD	12	ARCHIBALD FARMS	MARITIME PRIDE	Free Range
7000414456	MARITIME PRIDE GRADE A LRGEFRE	12	ARCHIBALD FARMS	MARITIME PRIDE	Free Range
7034600002	NATURALS GRADE A EXTRA LARGE 8	8	ROWE FARM MEATS	NATURALS	Normal
7034600003	. NATURALS GRADE ALARGE BR OWN	12	ROWE FARM MEATS	NATURALS	Normal/Brown
7034600005	GREEN VALLEY FREE RANGE GRADE	12	?	GREEN VALLEY	Free Range
7034600006	GREEN VALLEY GRADEA EXTRA LAR	12	?	GREEN VALLEY	Normal
7226600003	ARRCO GRADE A LARGE 12 S	12	?	ARRCO	Normal
7355700001	EGGS GRADE A EXTRA LARGE 12S (	12	UNBRANDED	UNBRANDED	Normal
7355700002	EGGS GRADE A LARGE	12	UNBRANDED	UNBRANDED	Normal
7355700003	EYKING DELIGHT GRADE A MEDIUM	12	?	EYKING DELIGHT	Normal
7355700005	EGGS GRADE A LARGE 12S (#7355	12	UNBRANDED	UNBRANDED	Normal
7355700010	EYKING DELIGHT GRADE A LARGE 8	8	?	EYKING DELIGHT	Normal
7355700011	EYKING DELIGHT GRADE A JUMBO 1	12	?	EYKING DELIGHT	Normal
7355700012	EYKING DELIGHT GRADE A EXTRA L	12	?	EYKING DELIGHT	Normal
7355700013	EYKING DELIGHT GRADE A LARGE 1	12	?	EYKING DELIGHT	Normal
7374400011	DR SIM OMEGA GRADE A LARGE 1	12	MURRYS	DR SIM	Omega 3
7383000001	ISLAND GOLD GRADE A EXTRA LARG	12	ISLAND EGGS	ISLAND GOLD	Normal
7383000002	EGGS GRADE A LARGE	12	UNBRANDED	UNBRANDED	Normal
7383000003	EGGS GRADE A MEDIUM	12	UNBRANDED	UNBRANDED	Normal
7383000004	EGGS GRADE A SMALL	12	UNBRANDED	UNBRANDED	Normal
7383000005	ISLAND GOLD GRADE A JUMBO WHIT	12	ISLAND EGGS	ISLAND GOLD	Normal
7383000007	EGGS GRADE A JUMBO12S (#00 007	12	UNBRANDED	UNBRANDED	Normal
7383000015	EGGS GRADE A EX LARGE 12S (#00	12	UNBRANDED	UNBRANDED	Normal
7383000020	EGGS GRADE A LARGEBROWN 12 S (	12	UNBRANDED	UNBRANDED	Normal/Brown
7383000021	ISLAND GOLD GRADE A LARGE BROW	12	ISLAND EGGS	ISLAND GOLD	Normal/Brown
7383000030	EGGS GRADE B MEDIUM 12S (#7383	12	UNBRANDED	UNBRANDED	Normal
7383000050	COOPERS GRADE A LARGE 18S (CL)	18	CONTROL LABEL	COOPERS	Normal
7383000060	ISLAND GOLD GRADE A LARGE WHIT	12	ISLAND EGGS	ISLAND GOLD	Normal
7383000075	EGGS GRADE A LARGEFREE RAN GE	12	UNBRANDED	UNBRANDED	Free Range
7383000085	ISLAND GOLD FREE RANGE GRADE A	12	ISLAND EGGS	ISLAND GOLD	Free Range

UPC	UPC Description	# of Eggs	Manufacturer Description	Brand Description	Sub Brand Description
7383000100	DAYBREAK FARMS GRADEA EXTRALAR	12	DAYBREAK FARMS	DAYBREAK FARMS	Normal
7383000120	SUNSHINE GRADE A LARGE 20S	20	DAYBREAK FARMS	SUNSHINE	Normal
7429009155	COUNTRY GOLDEN YOLK FREE RANGE	12	FRASER VALLEY	COUNTRY GOLDEN	Free Range
7429044546	COUNTRY GOLDEN YOLK GRADE A ME	12	FRASER VALLEY FARMS	COUNTRY GOLDEN	Free Range
7491000124	VITA EGG OMEGA 3 GRADE A LARGE	12	ACKRON EGG FARMS	VITA EGG	Omega 3
7511912448	ENER-G EGG REPLACER 510 GM		ENER G FOODS	ENER G	Processed
7723600030	ROSE ACRE FARMS GRADE A LARGE	12	?	ROSE ACRE FARMS	Normal
7738000060	DAYBREAK FARMS GRADE A LARGE 6	6	DAYBREAK FARMS	DAYBREAK FARMS	Normal
40004994612	GOLDEN VALLEY GRADE A LARGE 6S	6	FRASER VALLEY FARMS	GOLDEN VALLEY	Normal
62058000001	EGGS GRADE A EX LARGE 12S (#00	12	UNBRANDED	UNBRANDED	Normal
62058000002	EGGS GRADE A LARGE12S (#00 002	12	UNBRANDED	UNBRANDED	Normal
62058000003	EGGS GRADE A MEDIUM 12S (#0000	12	UNBRANDED	UNBRANDED	Normal
62575300001	EGGS GRADE A EX LARGE 12S (625	12	UNBRANDED	UNBRANDED	Normal
62575300004	SCOTIA GRADE A LARGE BROWN 12S	12	SCOTIA POULTRY	SCOTIA	Normal/Brown
62606800001	SCHMIDT GRADE A JUMBO 12S (#00	12	SCHMIDT FMLY FRMERS	SCHMIDT	Normal
62606800002	SCHMIDT GRADE A EXTRA LARGE12S	12	SCHMIDT FMLY FRMERS	SCHMIDT	Normal
62606800003	SCHMIDT GRADE A LARGE WHITE12S	12	SCHMIDT FMLY FRMERS	SCHMIDT	Normal
62606800004	SCHMIDTS GRADE A MEDIUM 12S(#0	12	SCHMIDT FMLY FRMERS	SCHMIDT	Normal
62606800005	SCHMIDT GRADE A SMALL 12S	12	SCHMIDT FMLY FRMERS	SCHMIDT	Normal
62606800023	SCHMIDT GRADE A LARGE 18S (#00	18	SCHMIDT FMLY FRMERS	SCHMIDT	Normal
62863230851	KELLYS ACRES GRADEA JUMBO FRE	12	KELLYS ACRES	KELLYS ACRES	Free Range
62863230852	KELLYS GRADE A EXTRA LARGE FRE	12	KELLYS ACRES	KELLYS ACRES	Free Range

UPC	UPC Description	# of Eggs	Manufacturer Description	Brand Description	Sub Brand Description
62863230853	KELLYS ACRES GRADE A LARGE FRE	12	KELLYS ACRES	KELLYS ACRES	Free Range
62863230854	KELLYS ACRES GRADEA MEDIUM FRE	12	KELLYS ACRES	KELLYS ACRES	Free Range
62864100002	SOBEYS GRADE A LARGE WHITE 12S	12	CONTROL LABEL	SOBEYS	Normal
65708811217	CHEF S CHOICE GRADE A LARGE 12	12	O&T POULTRY FARMS	CHEFS CHOICE	Normal
66693303597	CANADIAN HARVEST GRADE A LARGE	12	C S P FOODS	CANADIAN HARVEST	Normal
66693390042	BORN 3 GRADE A LARGE 12S(#9004	12	SHAFER HAGGART	BORN 3	Normal
76802700002	UNBRANDEDLARGE GR ADE A 12S(#0	12	UNBRANDED	UNBRANDED	Normal
76802700020	SUNSHINE GRADE A LARGE BROWN	12	KING CONE ICE CREAM	SUNSHINE	Normal/Brown
76802700030	SUNSHINE GRADE A MEDIUM 12S	12	KING CONE ICE CREAM	SUNSHINE	Normal
77000414403	MARITIME PRIDE OMEGA 3 GRADE A	12	ARCHIBALD FARMS	MARITIME PRIDE	Omega 3
77000414408	MARITIME PRIDE GRADE A LARGE 8	8	ARCHIBALD FARMS	MARITIME PRIDE	Normal
77000414418	MARITIME PRIDE GRADE A EXTRA L	12	ARCHIBALD FARMS	MARITIME PRIDE	Normal
77000414428	MARITIME PRIDE FREE RANGE GRAD	12	ARCHIBALD FARMS	MARITIME PRIDE	Free Range
77000414438	MARITIME PRIDE OMEGA 3 GRADE A	12	ARCHIBALD FARMS	MARITIME PRIDE	Omega 3
77000414448	MARITIME PRIDE GRADE A LARGE B	12	ARCHIBALD FARMS	MARITIME PRIDE	Normal/Brown
77000414456	MARITIME PRIDE GRADE A LRGEFRE	12	ARCHIBALD FARMS	MARITIME PRIDE	Free Range
77000414457	MARITIME PRIDE WISE CHOICE GRA	12	ARCHIBALD FARMS	MARITIME PRIDE	**Organic**
77000414470	MARITIME PRIDE GRADE A JUMBO 1	12	ARCHIBALD FARMS	MARITIME PRIDE	Normal
77000414471	MARITIME PRIDE GRADE A JUMBO B	12	ARCHIBALD FARMS	MARITIME PRIDE	Normal
77034600002	NATURALS GRADE A EXTRA LARGE 8	8	ROWE FARM MEATS	NATURALS	Normal
77034600003	. NATURALS GRADE ALARGE BR OWN	12	ROWE FARM MEATS	NATURALS	Normal/Brown
77034600022	NATURALS GRADE A BROWN LARGE B	12	ROWE FARM MEATS	NATURALS	Normal/Brown
77214900010	DELONG GRADE A EXTRA LARGE BRO	12	DELONG POULTRY FARMS	DELONG	Normal/Brown
77214900011	DELONG GRADE A EXTRA LARGE 12S	12	DELONG POULTRY FARMS	DELONG	Normal
77214900020	OLD SOUTHERN GRADEA LARGE 12S	12	OLD SOUTHERN PROD	OLD SOUTHERN	Normal
77214900021	DELONG GRADE A LARGE WHITE 12S	12	DELONG POULTRY FARMS	DELONG	Normal
77214900022	DELONG GRADE A LARGE BROWN 8S	8	DELONG POULTRY FARMS	DELONG	Normal/Brown
77214900030	DELONG GRADE A MEDIUM 12S(#000	12	DELONG POULTRY	DELONG	Normal

UPC	UPC Description	# of Eggs	Manufacturer Description	Brand Description	Sub Brand Description
			FARMS		
			DELONG POULTRY		Normal
77214900031	DELONG GRADE A MEDIUM 12S	12	FARMS	DELONG	
				AVICOLE DU	Normal
77214900041	AVICOLE DU NORD GRADE A LAR	12	AVICOLE DU NORD	NORD	
			DELONG POULTRY		Normal/Brown
77214900050	DELONG GRADE A JUMBO BROWN 12S	12	FARMS	DELONG	
77233200111	SWEETHEART GRADE ALARGE 12 S	12	?	SWEETHEART	Normal
77259600004	SUNSHINE ACRES EX LARGE GRADE	12	FARMERS RICE CO OP	SUNSHINE ACRES	Normal
77270000001	ROOYAKKER GRADE A EXTRA LARGE	12	ROOYAKKERS FARM	ROOYAKKER	Normal
77270000002	ROOYAKKERGRADE A LARGE WHITE	12	ROOYAKKERS FARM	ROOYAKKER	Normal
77270000003	ROOYAKKERGRADE A MEDIUM 12S	12	ROOYAKKERS FARM	ROOYAKKER	Normal
77270000005	ROOYAKKERGRADE A LARGE BROWN	12	ROOYAKKERS FARM	ROOYAKKER	Normal/Brown
77326700003	WEST GRADE A LARGE12S	12	WEST LINCOLN EGGS	WEST	Normal
77374400010	DR SIMS GRADE A EXLARGE 12 S	12	MURRYS	DR SIM	**Omega 3**
77374400011	DR SIM OMEGA GRADE A LARGE 1	12	MURRYS	DR SIM	Omega 3
77374400012	DR SIM GRADE A MEDIUM 12S	12	MURRYS	DR SIM	**Omega 3**
				DAYBREAK	Normal
77383000001	DAYBREAK FARMS GRADE A EXTRA L	12	DAYBREAK FARMS	FARMS	
77383000002	EGGS GRADE A LARGE	12	UNBRANDED	UNBRANDED	Normal
				DAYBREAK	Normal
77383000003	DAYBREAK FARMS GRADE A MEDIUM	12	DAYBREAK FARMS	FARMS	
				DAYBREAK	Normal
77383000004	DAYBREAK FARMS GRADE A SMALL 1	12	DAYBREAK FARMS	FARMS	
77383000005	ISLAND GOLD GRADE A JUMBO WHIT	12	ISLAND EGGS	ISLAND GOLD	Normal
77383000015	ISLAND GOLD GRADE A EXTRA LARG	12	ISLAND EGGS	ISLAND GOLD	Normal
				DAYBREAK	Normal
77383000020	DAYBREAK FARMS GRADE A LARGE	12	DAYBREAK FARMS	FARMS	
77383000021	ISLAND GOLD GRADE A LARGE BROW	12	ISLAND EGGS	ISLAND GOLD	Normal/Brown
77383000030	EGGS GRADE B MEDIUM 12S (#0003	12	UNBRANDED	UNBRANDED	Normal
77383000040	IGA GENERIC GRADE A MEDIUM BRO	12	GENERIC LABEL	I G A	Normal/Brown
				DAYBREAK	Normal
77383000050	DAYBREAK FARMS GRADE A LARGE 1	12	DAYBREAK FARMS	FARMS	

UPC	UPC Description	# of Eggs	Manufacturer Description	Brand Description	Sub Brand Description
77383000060	ISLAND GOLD GRADE A LARGE WHIT	12	ISLAND EGGS	ISLAND GOLD	Normal
77383000061	ISLAND GOLD GENERIC GRADE A LA	12	ISLAND EGGS	ISLAND GOLD	Normal
77383000070	DAYBREAK FARMS GRADE A LARGE B		DAYBREAK FARMS	DAYBREAK FARMS	Normal/Brown
77383000075	ISLAND GOLD FREE RANGE GRADE A	12	ISLAND EGGS	ISLAND GOLD	Free Range
77383000080	EGGS GRADE A MEDIUM	12	UNBRANDED	UNBRANDED	Normal
77383000085	ISLAND GOLD FREE RANGE GRADE A	12	ISLAND EGGS	ISLAND GOLD	Free Range
77383000087	ISLAND GOLD OMEGA 3 GRADE A LA	12	ISLAND EGGS	ISLAND GOLD	Omega 3
77383000090	ISLAND GOLD GRADE A VEGGIE LAR	12	ISLAND EGGS	ISLAND GOLD	Normal
77383000091	ISLAND GOLD GRADE A VEGGIE LAR	12	ISLAND EGGS	ISLAND GOLD	Normal
77383000100	DAYBREAK FARMS GRADEA EXTRALAR	12	DAYBREAK FARMS	DAYBREAK FARMS	Normal
77383000101	DAYBREAK FARMS GRADE A LARGE B	12	DAYBREAK FARMS	DAYBREAK FARMS	Normal
77383000120	SUNSHINE GRADE A JUMBO 20S	20	DAYBREAK FARMS	SUNSHINE	Normal
77429009155	COUNTRY GOLDEN YOLK FREE RANGE	12	FRASER VALLEY FARMS	COUNTRY GOLDEN	Free Range
77429009156	COUNTRY GOLDEN YOLK GRADE ALAR	12	?	COUNTRY GOLDEN	Free Range
77429044546	COUNTRY GOLDEN YOLK GRADE A ME	12	FRASER VALLEY FARMS	COUNTRY GOLDEN	Free Range
77429044549	COUNTRY GOLDEN YOLK FREERANGE	12	FRASER VALLEY FARMS	COUNTRY GOLDEN	Free Range
77491000103	VITA EGG GRADE A LARGE 18S	18	ACKRON EGG FARMS	VITA EGG	Normal
77491000105	VITA GRADE A EXTRA LARGE 12	12	ACKRON EGG FARMS	VITA EGG	Normal
77491000122	VITA EGG OMEGA 3 GRADE A LARGE	12	ACKRON EGG FARMS	VITA EGG	Omega 3
77491000124	VITA EGG OMEGA 3 GRADE A LARG	12	ACKRON EGG FARMS	VITA EGG	Omega 3
77491000150	VITA ORGANIC GRADE A LARGE 12S	12	ACKRON EGG FARMS	VITA EGG	Organic
77738000060	DAYBREAK FARMS GRADE A LARGE 6	6	DAYBREAK FARMS	DAYBREAK FARMS	Normal
77786000003	BRANCACCIO FARM GRADE A LARGE	12	BRANCACCIO FARMS	BRANCACCIO FARM	Normal
77888700102	FARMER BENS GRADE A LARGE 12S	12	FARMER BENS EGGS	FARMER BENS	Normal

UPC	UPC Description	# of Eggs	Manufacturer Description	Brand Description	Sub Brand Description
77888700202	FARMER BENS GRADE A LARGE BROW	12	FARMER BENS EGGS	FARMER BENS	Normal/Brown
77888700302	FARMER BENS DARK YOLK GRADE A	12	FARMER BENS EGGS	FARMER BENS	Normal
83031200003	MAPLE HILL GRADE ALARGE FR EE	12	?	MAPLE HILL	Free Range
83031200004	MAPLE HILL GRADE ALARGE FR EE	12	?	MAPLE HILL	Free Range
83031200007	MAPLE HILL ORGANIC LARGE 12S(#	12	?	MAPLE HILL	Organic
83031200008	MAPLE HILL ORGANIC GRADE A LAR	12	?	MAPLE HILL	Organic
85123200002	TWIN PINE GRADE A MEDIUM 12S	12	?	TWIN PINE	Normal
85702400001	MOUNTAIN GRADE A FREE RANGE ME	12	?	MOUNTAIN	Free Range
85702400002	MOUNTAIN GRADE A LARGE 12S(#00	12	?	MOUNTAIN	Normal
85702400004	MOUNTAIN GRADE A LARGE 12S (#0	12	?	MOUNTAIN	Normal
85702400005	MOUNTAIN GRADE A EXTRA LARGE 1	12	?	MOUNTAIN	Normal
85702400006	MOUNTAIN GRADE A FREE RANGE LA	12	?	MOUNTAIN	Free Range
85702400007	MOUNTAIN GRADE A FREE RANGE EX	12	?	MOUNTAIN	Free Range
85702400009	MOUNTAIN GRADE A LARGE 18S	18	?	MOUNTAIN	Normal
85702400011	MOUNTAIN GRADE A FREE RUN MED	12	?	MOUNTAIN	**Free Run**

Appendix 4. Sources used to identify the different egg products

General information on Canadian Egg Grading Stations and egg producers: http://www.agr.gc.ca/poultry/esta-entr_egr_e.htm. This site contains most of the information shown below.
Golden Valley Farms: http://www.goldenvalley.com/specialtyeggs.html . Products include omega 3, free run/range eggs, brown eggs and regular white eggs.
Burnbrae Farms: http://www.burnbraefarms.com/home.htm. Products include omega pro, omega 3 (Bon-ee-Best NaturEgg) free run eggs, Nature's Best/vitamin enhanced eggs, organic eggs and regular eggs.
Sunshine Organic farm: http://www.sunshineorganicfarm.com/product.htm.
Sparks Farms: http://www.sparkseggs.com/main.html. Products include free run, grain fed, omega 3, vitamin enhanced, organic and regular white eggs
Star Egg Company Ltd: http://www.staregg.sk.ca/index.html. Products include Omega 3, free run and regular white eggs. Star Egg was the first egg grading station in Canada to receive Canadian Food Inspection Agency (CFIA) recognition of its HACCP Program.
Gray Ridge Egg Farms: http://www.grayridge.com/English.html. Products include omega 3 eggs, free run eggs, premium branded eggs, green eggs, vitamin enhanced eggs and regular white eggs
Ovale: http://www.ovale.ca/an/03/index.htm. Products include regular white and brown eggs, free-range eggs, vitamin enhanced eggs, organic eggs
Eden Valley Farms: http://www.edenvalleyfarms.com/edenvalleyfarms/index.asp. Products include free range and free run eggs, The good morning egg (omega 3) and regular white eggs.
Born 3 Marketing Corp: http://www.born3.com/. Products include omega 3 eggs, brown eggs.
Lilydale Egg Co. http://www.flaxcouncil.ca/english/index.php?p=p8&mp=food. Products include omega 3 (Formula 3 eggs) and regular white and brown eggs.
Villetard's Eggs. http://www.flaxcouncil.ca/english/index.php?p=p8&mp=food. Products include Dr. Sim's Designer Eggs (Omega 3).
Wilcox Family Farms: http://www.wilcoxfarms.com/natprod.html. Products include Vita egg (vitamin enhanced), free run eggs (Wilcox Cage Free), and omega 3 eggs (Choice eggs) organic eggs and regular eggs.
Norco Egg Ranch: http://www.flaxcouncil.ca/english/index.php?p=p8&mp=food. Products include omega 3 eggs (Health Horizons)
For general information on all omega 3 eggs in Canada check the Flax Council of Canada site at: http://www.flaxcouncil.ca/english/index.php?p=p8&mp=food.
International Trade Canada. http://www.dfait-maeci.gc.ca/eicb/agric/EggProductsQHList2004-en.asp. This has information on all shell egg, egg products, powdered egg products and producers in Canada.
Canadian Poultry and Egg Processors Council (CPEPC). This site contains information on egg graders in Canada. http://www.cpepc.ca/about_cpepc/sector/egg_graders.asp.