# Kidfluence and the Quebec Advertising Ban ${ }^{1}$ 

Kathy Baylis<br>Food and Resource Economics Group, Land and Food Systems<br>341-2357 Main Mall, University of British Columbia, Vancouver, BC, Canada, V6T 1Z4<br>email: kbaylis@interchange.ubc.ca<br>Tirtha Dhar<br>Division of Marketing, Sauder School of Business 2053 Main Mall, University of British Columbia<br>Vancouver, BC, Canada, V6T1Z2<br>email: tirtha.dhar@sauder.ubc.ca<br>[Very Preliminary Draft: Please do not quote]

April 16, 2006

[^0]
#### Abstract

With the growing concern about childhood obesity and the associated health risks, several countries including the UK, Australia and to a limited degree, the United States, are considering banning food advertising directed to children. The Canadian province of Quebec has had experience with this type of policy since 1980, when the Province imposed a ban on all TV advertising to children under the age of 13 . In this paper, we look at whether the advertising ban affected consumer choice in Quebec. To the best of our knowledge this will be the first study to explore the effect of the Quebec ban with household level data.

Using data from the Canadian household expenditure survey and Canada Foodex surveys from 1986 to 1996, we ask whether consumption at fast food restaurants has increased or decreased after the ban. Specifically, we estimate a two-stage Quadratic Almost Ideal Demand System (Q-AIDS) for expenditure on different foods, toys and other expenditure, controlling for various demographics, such as income, ethnicity, language, and expenditure on cable TV.

One issue with using microdata is the presence of censoring. To control for those categories where we see zero expenditure, we use a modified version of the Amemiya (1974) and Shonkweiler and Yen (1999) methodology, and use simulated maximum likelihood to jointly estimate a decision to purchase (modeled using discrete choice mixed logit specification) and the amount to purchase (modelled using Quadratic Almost Ideal Demand (Q-AIDS) specification).

We test for the effect of the ban by considering changes in consumption as cable TV, which gives Quebec families access to stations from outside the province, and therefore unaffected by the ban. Following Goldberg (1990) we will also control for mother tongue as Anglophones have access to more sources of media from outside the province. Specifically, we test whether consumption of fast food by Francophones families in Quebec changed more markedly than consumption of Anglophones in Quebec and Francophones outside Quebec.


## 1 Introduction

Increasing concern about child obesity has led a number of countries to propose sweeping restrictions on food advertising directed to kids. Several studies have linked childhood obesity to television viewing, and TV advertisements have been targeted as a prime suspect (e.g. Crespo et al. 2001; Dietz and Gortmaker, 1985; Gortmaker et al. 1996; Boynton-Jarrett et al.; Giammattei et al. 2003; Halford et al. 2004 and You and Nayga, 2005). In response, the UK and Australia are considering outright bans on food advertisements to kids, and in 2004, United States Senator Tom Harkin introduced a bill to increase FCC restrictions on all advertising directed towards children. Groups on both sides of the debate have noted that bans already exist in some jurisdictions, such as the province of Quebec. Advertising lobby groups state that even with the ban, children in Quebec are no less obese than children in other parts of Canada (The Times, May 31, 2004), whereas proponents note studies showing that child advertising is effective in altering consumption choices. Although the Quebec law is widely referenced by both opponents and proponents of advertising bans, to the best of our knowledge there are very few academic studies conducted on the effect of the ban in Quebec. The objective of this paper is to analyze the effect of the advertising ban on consumption in Quebec by exploring changes in demand (e.g. the change in consumer demand for fast food). To the best of our knowledge this will be the first formal econometric study to explore the impact of the

Quebec law on consumption.
In 1980, the Quebec Consumer Protection Act banned advertising directed to children under the age of 13. Products and programs are rated according to their appeal to children, and products such as toys, sweets and food products cannot be advertised during children's programs. The result is that child television advertising is banned on Saturday and Sunday morning, and during the weekdays after school. As with the current proposed bans, the Quebec law was not without controversy. In one of the most famous free speech cases in Canada, this law was challenged by Irwin toys resulting in the Supreme Court of Canada upholding the ban in 1989. Recently, in the August 15th, 2005 issue of Marketing Magazine an article titled "Time to End It?" discusses the perceived drawbacks of the ban on Quebec TV programming. These concerns were echoed at Canadian Federal Standing Committee hearings in the Senate earlier in 2005, resulting in calls for the law to be revised or reversed.

We use Statistics Canada's detailed household expenditure data to explore the change in preferences due to the ban. This will be a distinct departure from existing studies as they are mainly based on cross sectional surveys and experiments. Using data from the annual Canadian household expenditure survey and Canada Foodex surveys from 1986 to 1996, we ask whether consumption at fast food restaurants and convenience stores has increased or decreased after the ban. We control for the expenditure on cable or satellite, internet usage etc. Specifically, we estimate a two-stage Quadratic

Almost Ideal Demand System (Q-AIDS) for expenditure on different foods, controlling for demographic characteristics, such as income, ethnicity, language, education and occupation. One issue with using microdata is the presence of censoring. To control for those categories where we see zero expenditure, we use a modified version of the methodology initially introduced by Amemiya (1974) and since used by Shonkweiler and Yen (1999), and use simulated maximum likelihood to jointly estimate a mixed logit as the selection equation and a non-linear Q-AIDS model.

Literature on the effect of advertisements on demand using behavioral marketing methodology and child psychology is already well developed (for a good review see Hastings et al., 2003) and generally finds strong evidence that product promotion to children has an effect, and that advertising tends to encourage the consumption of unhealthy food. To the best of our knowledge Goldberg (1990) is the only study that has looked at the effect of Quebec ban using a quasi- experimental setup. He uses the fact that Anglophone children in Quebec are likely less affected by the ban than Francophones, as Anglophones will watch more programming in English from stations originating outside the province. He finds that Anglophone children had stronger brand recognition than Francophones, and those children who watched a greater amount of television emanating from the United States, had a stronger awareness of toys and a larger number of children's cereals in their homes. Goldberg concludes that the law was successful in reducing children's exposure to cereals and toys and therefore reducing the pressure from children on their
parents to buy them. However, in his study he did not look at the effect of the ban on consumption patterns per se.

The paper proceeds as follows: in Section 2 we discuss the background of the legislation. Section 3 describes the database. In Section 4, we outline our empirical model. We present results from our empirical model in Section 5. And Section 6 we provide our concluding remarks.

## 2 Background

On April 30, 1980, the Quebec Consumer Protection Act came into force, banning advertising directed at children under the age of 13. Article 249 of Act the explains what criteria must be used to determine whether an advertisement is directed at children. These include:
a. The nature and intended purpose of goods advertised. For example, are the products consumed primarily by children?
b. The advertisement itself - does it use fantasy, magic, or children specific adventures?
c. The time and place the advertisement is shown.

During programs where children comprise less than 15 percent of the audience, advertisements that are directed at both children and adults are permitted. During programs where children are less than 5 percent of the viewers, advertisements directed mainly at children may be broadcast. Thus, the law does not formally ban all advertising to children. Stations may still broadcast advertisements during children's programmes as long as
the ads are not directed exclusively to children. Similarly, ads exclusively to children can still be broadcast, but only during programmes that are primarily watched by adults (Caron, 1994). Viewing levels (times and audience composition) are compiled by the Bureau of Broadcast Measurement and provided to advertisers.

Educational ads are allowed, however they are tightly regulated. For example, in 1984, McDonald's proposed a commercial where Ronald McDonald would explain to children the importance of wearing seat belts. This commercial was refused by l'Office de la Protection du Consommateur (the Consumer Protection Office) because it involved a known and well-liked children's character (Government of Canada and Gouvernement du Quebec, 1985).

One of the weaknesses with the legislation is that it only applies to signals originating inside Quebec. Thus, signals from outside Quebec (for example, from Ontario and the United States) transmitted by cable or terrestrial television are not subject to the regulations. Caron notes that although Francophone children are not likely to watch the English programs, Anglophone children do spend a large time watching these broadcasts that originate largely in the United States (Caron). We will use this fact to help identify the effect of the ban.

## 3 Database:

To study the effect of the ban, we use household level consumption and expenditure survey data from Statistics Canada. The biannual Canadian household expenditure survey provides detailed yearly purchase behavior of items like toys, clothing, and food and allows us to control for the expenditure on cable and satellite TV. The Canadian household expenditure survey (also called the Famex) is large, with a sample size that ranges between 10,000 (1996, 1992, 1986 and 1982) and 4,500 (1990 and 1984). The expenditure categories of concern to us in this study are Food, Shelter, Clothing, Recreation and Education, Transportation, Medical and Personal Care, and Other Household Expenses. Food includes all food expenditures, regardless of where purchased. Shelter includes rent and mortgage expenditure. Clothing includes all expenditure on clothing and footwear. Recreation and Education includes sporting goods, gym fees, entertainment equipment, CDs, DVDs, books and any show tickets. It also includes any fees and equipment associated with education. Transportation includes car purchase and operation, and public transportation costs. Medical and personal care includes all health care costs and personal care items such as toiletries. After 1986, the Famex also collected data on cable and satellite TV expenditure, which allowed us to control for access to TV stations originating outside of Quebec. In the surveys before 1990, data was collected on household entertainment, which included cable and satellite TV expenditure.

The Canada Foodex survey has detailed information on bi-weekly food purchase behavior of households. The survey is large (in 1996 it has household information and detailed food expenditure data for over 5,600 families) and has been conducted periodically since 1972. The information collected includes where food is purchased: including convenience stores, fast food outlets, other restaurants and grocery stores. The categories we use in this study are Vegetables including vegetable preparations, Fruits and nuts, fresh and processed, Meat, Fish, Dairy, Bakery and cereals, Sugar and confectionery, and Restaurant meals.

Both Foodex and Famex surveys have data by province and include detailed household and income descriptions which allow us to match consumption to demographic characteristics between the two surveys. Information on mother tongue is included in all survey except the two in 1996. For prices, we used the CPI by expenditure category by province normalized to 1982.

First, let us consider whether cable penetration in Quebec is so large in our time period as to completely negate the effect of the ban. Using data from the Household Expenditure Survey, we can track cable expenditure in Quebec versus the rest of Canada (see table 1).

Table 1: Percent of households with no cable or satellite TV expenditure Canada Quebec
199637
19923533
$1990 \quad 30 \quad 41$
Source: STATCAN Famex Survey various years
As can be seen from table 1, a significant number of households did not
subscribe to cable even well into the 1990s. This was particularly true for Francophones, 43 percent of whom had no cable expenditure in 1992, compared to 32 percent for Anglophones.

Prior to 1990, the household expenditure survey did not collect data on cable expenditure, only the more aggregate category of household entertainment expenditure, which includes cable and satellite TV, rental videos and movies. The household entertainment expenditure is approximately twice the expenditure on cable, and although positive household entertainment expenditure does not necessarily imply access to cable TV, we can be reasonably confident that if they had no entertainment expenditure, they did not have cable.

Table 2: Percent of households in Famex survey with no Household Entertainment Expenditure

Canada Quebec
$1996 \quad 17 \quad 18$

1992
18
26
1990
1986
198427
20
18
23
28
Thus, even using the broader entertainment category, there are still a large portion of Canadian households with no expenditure on cable, movies or videos, and that percentage is larger in Quebec. Therefore, there is evidence that the advertising restrictions may well have affected a significant share of the population in Quebec, and, as noted by Caron and Goldberg, there is also evidence that Quebec may have lower cable penetration than
other provinces.
To determine whether the advertising ban had an obvious effect on consumption, we consider the amount of fast food consumed inside and outside Quebec.

Table 3: Average biweekly fast-food expenditure in Quebec compared to the rest of Canada

|  | Rest of Canada | Quebec |
| :---: | :---: | :---: |
| 1996 | 481.8 | 363.8 |
| 1992 | 420.6 | 324.8 |
| 1986 | 381.8 | 339.7 |

Source: Foodex survey, various years
From table 3, it appears that there is some evidence that residents of Quebec consume less fast food than other parts of Canada. One concern with this anecdotal evidence is that perhaps Francophones have distinct eating habits. To address this, we use the consumption of fast food by Francophones outside of Quebec as a control, noting that Francophones in Quebec are more likely to be the most affected by the ban. Specifically, we take a difference in difference approach and compare the gap between Anglophones and Francophones in Quebec to the rest of Canada, expecting that if the ban has an effect, the gap should be larger in Quebec than the rest of Canada. As data was not collected on mother tongue in 1996, we can only use the 1986 and 1992 surveys (see table 4).

Table 4: Average biweekly fast-food expenditure by Francophones and Anglophones inside and outside of Quebec

| year | province | anglophone | francophone | difference |
| :---: | :---: | :---: | :---: | :---: |
| 1986 | Quebec | 319.8 | 268.3 | 51.6 |
|  | Rest of Canada | 300.3 | 295.9 | 4.4 |
| 1992 | Difference | 19.5 | -27.5 | 47.2 |
|  | Quebec | 409.5 | 313.3 | 96.3 |
|  | Rest of Canada | 436.0 | 351.9 | 84.0 |
|  | Difference | -26.5 | -38.6 | 12.3 |

source: STATCAN Foodex survey, 1986, 1992.
Although only anecdotal, there appears to be evidence that Francophones in Quebec are consuming less fast food than both their Anglophone counterparts in the province, and than their Francophone counterparts in the rest of Canada. More compelling, the difference between Anglophone and Francophone consumption inside Quebec is more pronounced inside Quebec than in the rest of Canada (allophones were excluded). In 1986, Francophones in Quebec spent $\$ 51$ less on fast-food than Anglophones in Quebec, while Francophones in the rest of the country only spent $\$ 4$ less than their Anglophone counterparts. Thus, the difference-in-difference was $\$ 47$. In 1992, Francophones in Quebec spent $\$ 96$ less than their Anglophone counterparts, whereas this difference in the rest of the country was $\$ 84$, giving a smaller difference-in-difference of $\$ 12$. These data are consistent with the hypothesis that the advertising restrictions have affected Francophones more than Anglophones in Quebec, and although some Francophones outside of the province will receive french language TV signals from Quebec, many will get their french language programming locally, where children's advertisements are allowed.

## 4 The Model:

In building a model for this study we face the following challenges:

1. Abundance of zero consumption by households of certain product categories.
2. Given the number of products the households consumes, it is almost impossible to estimate a single demand system.
3. We only observe one price for a given product category at a given time. As a result our price database does not contain quality variations in consumption by the household.

To overcome challenge [1] we control for censoring by utilizing mixed logit choice specification and then we incorporate this conditional distribution of choice into our final demand specification.

To overcome challenge [2] we estimate a multi-stage demand system following Gorman (1970). In this model, at the first stage household allocates income over a broad set of product categories (such as: food, clothing, health care etc.) and in the second stage household allocate resources within specific product categories on specific products (such as: breakfast cereals, sugar, vegetables within food product category). Details of the product categories and products are provided in the Data section of this paper.

### 4.1 The Choice Model:

As with most micro data, we have a problem of censoring. Following Amemiya, Wales and Woodland have proposed estimating demand systems by deriving share equations from a non-stochastic utility function, where latent shares are assumed to differ from the observed due to random disturbances affecting consumer behavior, errors in measurement etc., which result in an error term being added to the observed shares (Wales and Woodland 1983). The error terms are then truncated to satisfy non-negativity constraints. One issue with this approach is the need to evaluate multiple integrals in the likelihood function, making it computationally cumbersome.

A solution to this problem is to estimate the selection equation and quantity equations separately. Two-step estimators were initially proposed by Hein and Wessells (1990) based on a standard tobit. Their idea was to apply a probit to each selection equation and them estimate the budget shares using a system of equations (e.g. SUR) along with a correction factor, the inverse mills ratio, from the probit estimation. Shonkweiler and Yen (1999) note that the Hein and Wessells approach is inconsistent and propose a different modification, which we use here. One shortcoming of the Shonkweiler and Yen methodology is that the first stage is estimated using individual probit equations, thus assuming that the choice whether or not to consume a good is independent of the choice to consume other goods. A number of papers have followed, using simulated maximum likelihood (SML) to estimate a mul-
tivariate probit in the first stage (Harris and Shonkweiler, 1997; Yen and Lin, 2002; Yen, Lin and Smallwood, 2003; and Dong, Gould and Kaiser, 2004). Golan, Perloff and Shen (2001) use a similar framework but instead of using SML, they use maximum entropy to estimate censored demand, which allows them to relax the assumption of normality. In this paper, we use SML to estimate the selection and quantity equation simultaneously, using a mixed logit as the selection equation instead of the multivariate probit. The mixed logit allows us to relax the assumption of normally-distributed error terms, while also being less computationally arduous than the GHK simulator for the multivariate probit used by Dong, Gould and Kaiser (2004).

In the household consumer data, not all consumers purchase every category every period, thus we have censored data. One can write the observed expenditure shares, $s$ which are related to the latent shares, $s^{*}$, by (1)

$$
s=\left\{\begin{array}{c}
s^{*} \leq 0 ; s=0  \tag{1}\\
s^{*}>0 ; s=s^{*}
\end{array}\right.
$$

Assume whether to purchase is determined by (some) different factors than how much to buy. For example, ownership of storage space, certain kitchen appliances may be needed before one will purchase some goods (say foods needing a pressure cooker), whereas for others (e.g. Mac and cheese) one just needs a microwave. Similarly, having storage space may affect the quantity of products that one purchases, but not whether one purchases the good at all.

Let the selection equation be defined by:

$$
\begin{align*}
& d^{*}=\gamma^{\prime} w+\mu^{\prime} \nu+v  \tag{2}\\
& s^{*}=x^{\prime} \beta+\varepsilon \tag{3}
\end{align*}
$$

where $v$ and $\varepsilon$ are correlated. Thus, the share for product $g$ by household $l$ in province $r$ will be equal to the latent share if $d_{g l r}^{*}>0$. Thus,

$$
\begin{align*}
s_{g l r} & =s_{g l r}^{*} i f \nu_{g r}^{\prime} \mu_{g l r}+v_{g l r}>-\gamma_{g r}^{\prime} w_{g l r} \\
& =0 \text { otherwise } . \tag{4}
\end{align*}
$$

The selection component is estimated using a mixed logit model, where $z$ is a vector of error terms, which, along with $v$ defines the stochastic portion of utility (Train, 2003). The mixed logit model is based on the assumption that the unobserved portion of the utility consists of a part that follows any distribution specified by the researcher plus a portion that is iid extreme value. Using the mixed logit, one can determine the probability of observing a censored or uncensored budget share, giving the unconditional mean of the budget share as:

$$
\begin{equation*}
E\left(s_{g l r} \mid x_{g l r}, w_{g l r}\right)=\Phi_{g r}\left(w_{g r}^{\prime} \gamma_{g l r}\right) x_{g l r}^{\prime} \beta_{g r}+\delta_{g l r} \phi_{g r}\left(w_{g r}^{\prime} \gamma_{g l r}\right) \tag{5}
\end{equation*}
$$

where $\Phi_{g r}$ and $\phi_{g r}$ are the CDF and PDF respectively associated with the probability of observing a censored outcome.

Following Shonkweiler and Yen (1999) one can write the system of budget share equations as:

$$
\begin{equation*}
s_{g l r}=\Phi_{g}\left(w_{g r}^{\prime} \gamma_{g l r}\right) x_{g l r}^{\prime} \beta_{g r}+\delta_{g r} \phi_{g}\left(w_{g r}^{\prime} \gamma_{g l r}\right)+\xi_{g l r} \tag{6}
\end{equation*}
$$

Unlike Shonkweiler and Yen, we plan to estimate choice and demand specification simultaneously using SML.

### 4.2 The Demand Model (Q-AIDS):

As mentioned earlier, for the purpose of tractability and manageability we will develop a demand system using the concept of multi-stage budgeting. We will use Quadratic Almost Ideal Demand Specification to estimate household demand. In the first stage we will estimate demand for product categories such as: food and clothing, and in the second stage we will estimate disaggregate product level demand.

Following Blundell and Robin (2000), let $e(p, u)$ be the household expenditure function, where $p \in R_{++}^{n}$ is the $(n \times 1)$ price vector of the $(n \times 1)$ vector of consumption goods $q \in R_{+}^{n}$, and $u$ is a reference utility level. Under the almost ideal class of demand systems, $\ln e(p, u)=\ln a(p)+c(p)\left[d(b)+u^{-1}\right]^{-1}$, where $\ln a(p)=\alpha_{0}+\alpha^{T} \ln p+1 / 2 *(\ln p)^{T} \Gamma(\ln p), \ln c(p)=\beta^{T} \ln p$ and $d(p)=\tau^{T} \ln p$ (Banks, Blundell and Lewbell, 1997). Let $k_{n}$ denote the $(n \times 1)$ vector $[k \ldots k]^{\prime}$, where $k$ is a scalar. The parameters $(\alpha, \beta, \tau, \Gamma)$ satisfy the restrictions: $\alpha^{T} 1_{n}=1, \beta^{T} 1_{n}=0, \tau^{T} 1=0, \Gamma 1_{n}=0_{n}$ (homogeneity and adding up restrictions), and $\Gamma^{T}=\Gamma$ (symmetry). Letting $M>0$ be household income, the corresponding Marshallian expenditure share $s=$ $\left(p_{1} q_{1}^{*} / M, \ldots, p_{n} q_{n}^{*} / M\right)^{T}$ are:

$$
\begin{equation*}
s=\alpha+\Gamma \ln p+\beta[\ln M-\ln a(p)]+\frac{\tau}{c(p)}[\ln M-\ln a(p)]^{2} \tag{7}
\end{equation*}
$$

Our first stage budget specification will be the following:

$$
\begin{equation*}
s_{g l r}=\alpha_{g}+\sum_{g=1}^{G} \gamma_{g g \prime} \ln \left(P_{g l r}\right)+\beta_{g r}\left(\frac{M_{l r}}{P_{l r}}\right)+\frac{\tau_{g}}{\prod_{g=1}^{G} P_{g l r}^{\beta_{g}}} \ln \left(\frac{M}{P_{l r}}\right)^{2} \tag{8}
\end{equation*}
$$

where $P=\left(P_{1}, \ldots, P_{G}\right)^{\prime}$ is a $(G \times 1)$ vector of price indices for products categories from the estimated second stage, and $s_{g l r}$ is the budget share for the $g^{\text {th }}$ product category consumed in the $l^{\text {th }}$ household residing at $r^{\text {th }}$ province.

In the second stage again we will use Q-AIDS to estimate household product level demand. Given the multidimensional household consumption database we can specify our Q-AIDS specification as:

$$
\begin{equation*}
s_{i l r}^{G}=\alpha_{i}^{G}+\sum_{j=1}^{N} \gamma_{i j}^{G} \ln \left(p_{j l r}\right)+\beta_{i}^{G} \ln \left(\frac{M_{l r}^{G}}{P_{l r}^{G}}\right)+\frac{\tau_{i}^{G}}{\prod_{i=1}^{N} p_{i l r}^{\beta_{i}^{G}}} \ln \left(\frac{M_{l r}^{G}}{P_{l r}^{G}}\right)^{2} \tag{9}
\end{equation*}
$$

Similarly here $p=\left(p_{1}, \ldots, p_{N}\right)$ is a $(N \times 1)$ price vector of products. The term $P^{G}$ is a price index expressed as: $\ln \left(P_{l r}^{G}\right)=\delta+\sum_{m=1}^{N} \alpha_{m}^{G} \ln \left(p_{m l r}\right)+$ $\frac{1}{2} \sum_{m=1}^{N} \sum_{j=1}^{N} \gamma_{m j}^{G} \ln \left(p_{m l r}\right) \ln \left(p_{j l r}\right)$. This estimated price index of the second stage is used to estimate first stage of the demand specification.

The above AIDS specification (9) can be modified to incorporate the effects of socio-demographic variables $\left(z_{1 l r}, \ldots, z_{K l r}\right)$ on consumption behavior, where $z_{k l r}$ is the $k^{\text {th }}$ socio-demographic variable in the $l^{t h}$ household residing in $r^{t h}$ province, $k=1, \ldots, K .$. This can be done by specifying
the parameters $\alpha$ to depend on $z$. This allows demographic effects to affect consumption behavior by generating variations in elasticity estimates. Under demographic translating, we assume that $\alpha_{i}$ takes the following form: $\alpha_{i}=\alpha_{0 i}+\sum_{k=1}^{K} \lambda_{i k} z_{k l r}, i=1, \ldots, N$.

As a result, our AIDS model incorporates a set of dummy variables to control for mother tongue, cable TV ownership along with selected sociodemographic variables. To maintain theoretical consistency of the AIDS model, the following restrictions based on adding up restrictions are applied to demographic translating parameter $\alpha_{0 i}$ :

$$
\begin{equation*}
\alpha_{0 i}=\sum_{r=1}^{9} d_{i f} D_{f}, \sum_{f=1}^{F} d_{i f}=1, i=1, \ldots, N \tag{10}
\end{equation*}
$$

where $d_{i f}$ is the parameter for the $i^{\text {th }}$ product associated with the dummy variable $D_{f}$ for the $f^{\text {th }}$ language. Note that as a result, our demand equations do not have intercept terms.

Details of the demand shifters and dummy variables are discussed in the data description section of the paper.

## 5 Empirical Model Specifications and Results

At the product category level we use the following product categories to estimate our demand system: Food, Shelter, Clothing, Recreation, Transportation, Health Care, and Other Household Expenses. For our initial regression, in the second stage we only estimate detailed product level demand only for the food categories using FoodEx survey data. At the second stage
food demand system the specification is based on the following products: Vegetables, Meat, Fish, Dairy, Bakery, Fruits and Nuts, Sugar, Restaurants. The following variables are used for demographic translating: for the first stage of the demand specification we use Size of the residence, Income after tax, Number of household members below 15 years of age, Number of family members, a dummy for Cable, Dummies for mother tongue. For the second stage of demand specification we use the same set of translating variables excluding Size of residence and Cable dummies. The first variable was dropped as household food consumption tends not to depend on the size of the household rather on the composition of the household members. The second dummy variable was dropped as the FoodEx data file does not contain such information.

We use full information maximum likelihood to estimate the demand systems. At this stage we are in the process of estimating both the choice and demand systems as a simultaneous system using SML. Here we present only the results from our regression model. We estimate demand systems for the following years: in the case of first stage 1986, 1992, and 1996 and in the case of second stage 1992 and 1996. As a result we get a snapshot of how consumption behavior changed over the years since the ban. The year 1986 was chosen as this is one of the early years of the ban. The other two years provide a indication of the long run effects of the ban. The reason for choosing two years to explore long term effects was to capture specific effects of Cable penetration at the household level. For example, the household level
cable penetration increased significantly from 41 percent to 33 percent from 1990 to 1996.

Estimated price elasticities of both the stages of the estimated demand models are presented in Table 1 and Table 2. We test and compare estimated elasticities across comparable provinces and across households with different mother tongue. For most food products and product categories we do not find any significant differences between Quebec and the other provinces. At the category level first stage demand model, Quebec households have significantly lower own price elasticity for food than comparable other provinces (i.e., Ontario and British Columbia). Similarly at the second stage within the food product category, own price elasticities for Restaurants is significantly lower for Quebec than comparable provinces. Interestingly, these differences decrease over the years from 1986 to 1996 implying increase in cable penetration may have decreased effectiveness of this ban.

## 6 Concluding Remarks

In our initial results we do not find overwhelming evidence of effectiveness of Quebec advertising ban. In products and product categories where we expect significant effects, Quebec households tended to show more inelastic demand than other provinces. If the role of advertising is to inform consumers about price and product attributes then our results suggest lack of advertising has been diminishing competitiveness of market places. This is an area we would like to explore further. Given the current level concern regarding the influence
of advertising on children we believe our current study will be able to shed light on effects of advertising on household consumption.

Further work will focus on refining our technique and estimating demand for more detailed food categories (e.g. fast food, food from convenience stores, candy, soda pop) and detailed non-food categories (toys and children's clothing). We believe that with this estimation we will be better able to determine the effects of the ban.

## References:

1. Amemiya, T. 1974. "Multivariate Regression and Simultaneous Equation Models when the Dependent Variables are Truncated Normal" Econometrica 42(6): 999-1012.
2. Banks, J., R.W. Blundell, and A. Lewbel. "Quadratic Engel Curves, Indirect Tax Reform and Welfare Measurement" Review of Economics and Statistics 79(1997): 527-539.
3. Blundell, R. W., and J-M. Robin. "Latent Separability: Grouping Goods Without Weak Separability" Econometrica 68(2000): 53-84.
4. Boynton-Jarrett, R. T. N. Thomas, K.E. Peterson, J. Wiecha, A.M. Sobol and S.L. Gortmaker. 2003. "Impact of Television Viewing Patterns on Fruit and Vegetable Consumption Among Adolescents," Pediatrics 112: 1321-6.
5. Caron, Andre. 1994. "Children, Advertising and Television Choices in a New Media Environment" in Children and Advertising: A Fair Game? Stephen Frith and Barbara Biggins eds, New College Institute for Values Research: University of New South Wales: 94-111.
6. Crespo, C.E. E. Smit, R. Trojano, S. Bartlett, C. Macera and R. Anderse. 2001 "Television Watching, Energy Intake and Obesity in U.S. Children" Archives of Pediatrics \& Adolescent Medicine 155:360-365. Dietz, W. and S. Gortmaker, 1985. "Do We Fatten Our Children at
the Television Set? Obesity and Television Viewing in Children and Adolescents", Pediatrics 75: 807-12.
7. Dong, D., B.W. Gould and H. M.Kaiser. 2004. "Food Demand in Mexico: An Application of the Amemiya-Tobin Approach to the Estimation of a Censored Food System" American Journal of Agricultural Economics 86(4): 1094-1107.
8. Giammattei, J., G. Blix, H.H.Marshak, A.O. Wollitzer and D.J. Pettitt. 2003. "Television Viewing as a Cause of Increasing Obesity Among Children in the United States." Archives of Pediatrics \& Adolescent Medicine 157: 882-6.
9. Golan, A., J. M. Perloff and E. Z. Shen. 2001. "Estimating a Demand System with Non negativity Constraints: Mexican Mean Demand," Review of Economics and Statistics 83(3): 541-550.
10. Goldberg, M.E. 1990. "A Quasi-Experiment Assessing the Effectiveness of TV Advertising Directed to Children" Journal of Marketing Research 27(4): 445-54.
11. Gorman, W.M. (1970), "Two-stage budgeting" in C. Blackorby and A.F. Shorrocks (eds.), Separability and aggregation. Collected works of W.M. Gorman. Volume I, Clarendon Press Oxford, pp. 22-29.
12. Gortmaker, S. A. Must, A. Sobol, K. Peterson, G. Colditz and W. Dietz. 1996. "Television Viewing as a Cause of Increasing Obesity

Among Children in the United States." Archives of Pediatrics ${ }^{63}$ Adolescent Medicine 150: 356-62.
13. Government of Canada and the Gouvernement du Quebec. 1985. Les effects de la loi quebecoise interdisant la publicite destinee aux entfants. Rapport du Comite federal-provincial sur la publicite destinee aux entfants. Septembre.
14. Halford, J. J. Gillispie, V. Brown, E. Pontin and T. Dovey. 2004. "Effect of Television Advertisements for Foods on Food Consumption in Children" Appetite 42: 221-5.
15. Harris, T.R. and J.S. Shonkweiler. 1997. "Interdependence of Retail Business," Growth and Change 28: 520-33.
16. Hastings, G.M. Stead, L McCermott, A. Forsyth, A.M. MacKintosh, M. Rayner, C. Godfrey, M. Caraher and K. Angus. 2003. Review of Research on the Effects of Food Promotion to Children Final Report. University of Strathclyde, Centre for Social Marketing, Glasgow.
17. Heien, D. and C.R. Wessells. 1990. "Demand Systems Estimation with Microdata: A Censored Regression Approach," Journal of Business and Economic Statistics 8: 365-71.
18. Shonkweiler, J.S. and S.T. Yen. 1999. "Two=step Estimation of a Censored System of Equations," American Journal of Agricultural Economics 81: 972-82.
19. Train, Kenneth E. 2003. Discrete Choice Methods with Simulation. University Press: Cambridge, UK.
20. The Times. 2004. "Labour will ban junk-food adverts on TV" (May 31).
21. Wales, T.J. and A.D. Woodland 1983. "Estimation of Consumer Demand Systems with Binding Non-Negativity Constraints" Journal of Econometrics 21: 263-85.
22. Yen, S.T. and B. Lin. 2002. "Beverage Consumption among US Children and Adolescents: Full-Information and Quasi Maximum-Likelihood Estimation of a Censored System" European Review of Agricultural Economics 29: 85-103.
23. Yen, S.T., B. Lin and D. Smallwood. 2003. "Quasi- and SimulatedLikelihood Approaches to Censored Demand Systems: Food Consumption by Food Stamp Recipients in the United States," American Journal of Agricultural Economics 85(2): 458-478.
24. You, W. and R. M. Nayga. 2005. "Fast Food, Television Viewing and Children's Dietary Quality", Journal of Agricultural and Resource Economics 30(2): 302-14.

Table 1: Price elasticities of food in the first stage

| 1986.000 |  |  |
| :---: | :---: | :---: |
| Province | Price elastities of Food | Expenditure Elasticities |
| Atlantic Provinces | -1.208 | 0.644 |
| Quebec | -1.198 | 0.648 |
| Ontario | -1.222 | 0.616 |
| Manitoba and Saskatchewan | -1.217 | 0.625 |
| Alberta | -1.231 | 0.603 |
| British Columbia | -1.211 | 0.637 |
| 1992.000 |  |  |
| Newfoundland | -1.666 | 0.669 |
| Prince Edward Island | -1.716 | 0.644 |
| Nova Scotia | -1.705 | 0.650 |
| New Brunswick | -1.739 | 0.633 |
| Quebec | -1.659 | 0.668 |
| Ontario | -1.728 | 0.638 |
| Manitoba | -1.725 | 0.639 |
| Saskatchewan | -1.763 | 0.621 |
| Alberta | -1.757 | 0.623 |
| British Columbia | -1.734 | 0.635 |
| 1996.000 |  |  |
| Newfoundland | -0.568 | 0.670 |
| Prince Edward Island | -0.544 | 0.652 |
| Nova Scotia | -0.561 | 0.665 |
| New Brunswick | -0.564 | 0.667 |
| Quebec | -0.599 | 0.694 |
| Ontario | -0.548 | 0.656 |
| Manitoba | -0.561 | 0.665 |
| Saskatchewan | -0.534 | 0.644 |
| Alberta | -0.526 | 0.638 |
| British Columbia | -0.559 | 0.664 |

*Highlighted estimates are significant at the 5\% level

Table: Price and Expenditure Elasticities by Food Products

|  | Newfoundland |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Veggies | Meat | Fish | Dairy | Bakery | Fruitnut | Sugar | Restaurant | Income el. |
| Veggies | -1.227 | -0.369 | 0.236 | -0.665 | 0.219 | -0.246 | 0.251 | 0.174 | 1.627 |
| Meat | -0.666 | -0.651 | 0.070 | 0.520 | 0.292 | -0.150 | -0.147 | -0.095 | 0.828 |
| Fish | 0.267 | 0.010 | -1.360 | 0.173 | -0.193 | 0.050 | 0.012 | 0.009 | 1.032 |
| Dairy | -2.980 | 1.088 | 1.121 | -0.384 | 2.209 | -0.156 | -0.121 | -1.603 | 0.826 |
| Bakery | 0.459 | 0.181 | -0.258 | 0.602 | -1.330 | 0.065 | -0.218 | -0.206 | 0.705 |
| Fruitnut | -0.167 | -0.075 | 0.154 | -0.031 | 0.071 | -0.756 | -0.061 | 0.172 | 0.693 |
| Sugar | 0.747 | -0.151 | 0.065 | -0.057 | -0.421 | -0.134 | -1.191 | 0.259 | 0.884 |
| Fast food | 1.221 | -0.214 | 0.143 | -1.819 | -0.902 | 0.656 | 0.659 | -0.394 | 0.649 |


| Prince Edward Island |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Veggies | Meat | Fish | Dairy | Bakery | Fruitnut | Sugar | Restaurant | Income el. |
| Veggies | -1.209 | -0.336 | 0.216 | -0.607 | 0.200 | -0.224 | 0.229 | 0.159 | 1.571 |
| Meat | -0.737 | -0.613 | 0.077 | 0.576 | 0.323 | -0.166 | -0.163 | -0.105 | 0.809 |
| Fish | 0.325 | 0.012 | -1.438 | 0.211 | -0.235 | 0.060 | 0.014 | 0.011 | 1.039 |
| Dairy | -2.060 | 0.752 | 0.775 | -0.574 | 1.527 | -0.108 | -0.084 | -1.108 | 0.880 |
| Bakery | 0.464 | 0.182 | -0.260 | 0.607 | -1.333 | 0.065 | -0.220 | -0.208 | 0.703 |
| Fruitnut | -0.167 | -0.076 | 0.155 | -0.031 | 0.071 | -0.755 | -0.061 | 0.173 | 0.691 |
| Sugar | 0.670 | -0.136 | 0.058 | -0.051 | -0.378 | -0.120 | -1.171 | 0.232 | 0.896 |
| Fast food | 0.994 | -0.175 | 0.116 | -1.479 | -0.733 | 0.533 | 0.536 | -0.507 | 0.715 |


|  |  |  |  | New Brun | swick |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Veggies | Meat | Fish | Dairy | Bakery | Fruitnut | Sugar | Restaurant | Income el. |
| Veggies | -1.191 | -0.307 | 0.197 | -0.556 | 0.184 | -0.205 | 0.209 | 0.146 | 1.523 |
| Meat | -0.696 | -0.635 | 0.073 | 0.544 | 0.305 | -0.157 | -0.154 | -0.099 | 0.820 |
| Fish | 0.334 | 0.012 | -1.450 | 0.216 | -0.241 | 0.062 | 0.015 | 0.012 | 1.041 |
| Dairy | -2.448 | 0.894 | 0.921 | -0.494 | 1.814 | -0.128 | -0.099 | -1.317 | 0.857 |
| Bakery | 0.464 | 0.182 | -0.260 | 0.608 | -1.333 | 0.065 | -0.220 | -0.208 | 0.703 |
| Fruitnut | -0.165 | -0.075 | 0.153 | -0.030 | 0.070 | -0.759 | -0.060 | 0.171 | 0.696 |
| Sugar | 0.749 | -0.152 | 0.065 | -0.057 | -0.423 | -0.135 | -1.191 | 0.260 | 0.884 |
| Fast food | 1.028 | -0.181 | 0.120 | -1.530 | -0.759 | 0.552 | 0.555 | -0.490 | 0.705 |

Quebec


| Meat | -0.711 | $-\mathbf{0 . 6 2 8}$ | 0.074 | 0.555 | 0.311 | -0.160 | -0.157 | -0.101 | $\mathbf{0 . 8 1 6}$ |
| :--- | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| Fish | 0.361 | 0.013 | $\mathbf{- 1 . 4 8 7}$ | 0.234 | -0.261 | 0.067 | 0.016 | 0.013 | $\mathbf{1 . 0 4 4}$ |
| Dairy | $\mathbf{- 2 . 1 6 8}$ | 0.791 | 0.815 | $\mathbf{- 0 . 5 5 2}$ | $\mathbf{1 . 6 0 6}$ | -0.114 | $-\mathbf{- 0 . 0 8 8}$ | -1.166 | $\mathbf{0 . 8 7 4}$ |
| Bakery | 0.516 | 0.202 | -0.289 | 0.676 | $\mathbf{- 1 . 3 7 1}$ | 0.073 | -0.245 | -0.231 | $\mathbf{0 . 6 6 9}$ |
| Fruitnut | -0.166 | -0.076 | 0.154 | -0.031 | 0.071 | -0.757 | -0.061 | 0.172 | $\mathbf{0 . 6 9 4}$ |
| Sugar | 0.713 | -0.144 | $\mathbf{0 . 0 6 2}$ | -0.054 | -0.402 | -0.128 | $\mathbf{- 1 . 1 8 2}$ | 0.247 | $\mathbf{0 . 8 8 9}$ |
| Fast food | 1.111 | -0.195 | $\mathbf{0 . 1 3 0}$ | -1.654 | -0.820 | 0.597 | 0.600 | $\mathbf{- 0 . 4 4 9}$ | $\mathbf{0 . 6 8 1}$ |


| Ontario |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Veggies | Meat | Fish | Dairy | Bakery | Fruitnut | Sugar | Restaurant | Income el. |
| Veggies | -1.166 | -0.268 | 0.172 | -0.485 | 0.160 | -0.179 | 0.183 | 0.127 | 1.457 |
| Meat | -0.729 | -0.618 | 0.076 | 0.570 | 0.320 | -0.164 | -0.162 | -0.104 | 0.811 |
| Fish | 0.362 | 0.013 | -1.488 | 0.235 | -0.262 | 0.067 | 0.016 | 0.013 | 1.044 |
| Dairy | -2.221 | 0.811 | 0.835 | -0.540 | 1.646 | -0.116 | -0.090 | -1.195 | 0.871 |
| Bakery | 0.523 | 0.205 | -0.293 | 0.685 | -1.376 | 0.074 | -0.248 | -0.234 | 0.665 |
| Fruitnut | -0.177 | -0.081 | 0.164 | -0.033 | 0.076 | -0.741 | -0.065 | 0.183 | 0.673 |
| Sugar | 0.661 | -0.134 | 0.058 | -0.050 | -0.373 | -0.119 | -1.169 | 0.229 | 0.897 |
| Fast food | 1.166 | -0.205 | 0.136 | -1.735 | -0.861 | 0.626 | 0.629 | -0.422 | 0.665 |


| Manitoba |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Veggies | Meat | Fish | Dairy | Bakery | Fruitnut | Sugar | Restaurant | Income el. |
| Veggies | -1.192 | -0.312 | 0.200 | -0.564 | 0.186 | -0.208 | 0.212 | 0.148 | 1.531 |
| Meat | -0.688 | -0.640 | 0.072 | 0.537 | 0.301 | -0.155 | -0.152 | -0.098 | 0.822 |
| Fish | 0.337 | 0.012 | -1.454 | 0.218 | -0.243 | 0.062 | 0.015 | 0.012 | 1.041 |
| Dairy | -2.172 | 0.793 | 0.817 | -0.551 | 1.609 | -0.114 | -0.088 | -1.168 | 0.873 |
| Bakery | 0.530 | 0.208 | -0.298 | 0.695 | -1.381 | 0.075 | -0.252 | -0.238 | 0.659 |
| Fruitnut | -0.161 | -0.073 | 0.149 | -0.030 | 0.069 | -0.765 | -0.059 | 0.166 | 0.704 |
| Sugar | 0.625 | -0.127 | 0.055 | -0.048 | -0.353 | -0.112 | -1.160 | 0.217 | 0.903 |
| Fast food | 1.149 | -0.202 | 0.134 | -1.711 | -0.848 | 0.617 | 0.620 | -0.430 | 0.670 |


|  | Saskatchewan |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Veggies | Meat | Fish | Dairy | Bakery | Fruitnut | Sugar | Restaurant | Income el. |
| Veggies | -1.202 | -0.326 | 0.209 | -0.589 | 0.194 | -0.217 | 0.222 | 0.154 | 1.554 |
| Meat | -0.685 | -0.641 | 0.072 | 0.536 | 0.300 | -0.154 | -0.152 | -0.098 | 0.823 |
| Fish | 0.312 | 0.011 | -1.421 | 0.202 | -0.226 | 0.058 | 0.014 | 0.011 | 1.038 |
| Dairy | -2.345 | 0.856 | 0.882 | -0.515 | 1.738 | -0.123 | -0.095 | -1.261 | 0.863 |
| Bakery | 0.525 | 0.206 | -0.294 | 0.687 | -1.377 | 0.074 | -0.249 | -0.235 | 0.664 |


| Fruitnut | -0.156 | -0.071 | 0.144 | -0.029 | 0.067 | -0.772 | -0.057 | 0.161 | $\mathbf{0 . 7 1 2}$ |
| :--- | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| Sugar | 0.684 | -0.139 | $\mathbf{0 . 0 6 0}$ | -0.052 | -0.386 | -0.123 | $\mathbf{- 1 . 1 7 5}$ | 0.237 | $\mathbf{0 . 8 9 4}$ |
| Fast food | 1.103 | -0.194 | $\mathbf{0 . 1 2 8}$ | -1.641 | -0.814 | 0.592 | 0.595 | $-\mathbf{0 . 4 5 3}$ | $\mathbf{0 . 6 8 3}$ |


| Alberta |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Veggies | Meat | Fish | Dairy | Bakery | Fruitnut | Sugar | Restaurant | Income el. |
| Veggies | -1.177 | -0.287 | 0.184 | -0.517 | 0.171 | -0.191 | 0.195 | 0.136 | 1.487 |
| Meat | -0.627 | -0.671 | 0.066 | 0.490 | 0.275 | -0.141 | -0.139 | -0.089 | 0.838 |
| Fish | 0.378 | 0.014 | -1.510 | 0.245 | -0.273 | 0.070 | 0.017 | 0.013 | 1.046 |
| Dairy | -2.132 | 0.778 | 0.802 | -0.559 | 1.580 | -0.112 | -0.087 | -1.147 | 0.876 |
| Bakery | 0.521 | 0.204 | -0.293 | 0.683 | -1.375 | 0.074 | -0.247 | -0.234 | 0.666 |
| Fruitnut | -0.164 | -0.075 | 0.152 | -0.030 | 0.070 | -0.760 | -0.060 | 0.170 | 0.697 |
| Sugar | 0.674 | -0.137 | 0.059 | -0.051 | -0.381 | -0.121 | -1.172 | 0.234 | 0.895 |
| Fast food | 1.128 | -0.198 | 0.131 | -1.679 | -0.832 | 0.606 | 0.609 | -0.440 | 0.676 |
| British Columbia |  |  |  |  |  |  |  |  |  |
|  | Veggies | Meat | Fish | Dairy | Bakery | Fruitnut | Sugar | Restaurant | Income el. |
| Veggies | -1.192 | -0.311 | 0.199 | -0.562 | 0.185 | -0.207 | 0.212 | 0.147 | 1.529 |
| Meat | -0.630 | -0.670 | 0.066 | 0.492 | 0.276 | -0.142 | -0.140 | -0.090 | 0.837 |
| Fish | 0.359 | 0.013 | -1.484 | 0.233 | -0.259 | 0.067 | 0.016 | 0.013 | 1.044 |
| Dairy | -2.138 | 0.780 | 0.804 | -0.558 | 1.584 | -0.112 | -0.087 | -1.150 | 0.875 |
| Bakery | 0.486 | 0.190 | -0.273 | 0.637 | -1.349 | 0.069 | -0.230 | -0.218 | 0.688 |
| Fruitnut | -0.167 | -0.076 | 0.155 | -0.031 | 0.071 | -0.755 | -0.061 | 0.173 | 0.692 |
| Sugar | 0.683 | -0.138 | 0.060 | -0.052 | -0.385 | -0.123 | -1.174 | 0.237 | 0.894 |
| Fast food | 1.002 | -0.176 | 0.117 | -1.491 | -0.739 | 0.538 | 0.541 | -0.503 | 0.712 |

*Highlighted estimates are significant at the $5 \%$ level

## Price elasticities

|  | Veggies | Meat | Fish | Dairy | Bakery | Fruitnut | Sugar | Restaurant | Income el. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Veggies | -0.633 | 0.075 | 0.706 | -0.213 | -0.414 | -0.208 | -0.489 | -0.158 | 1.333 |
| Meat | 0.237 | -1.399 | 0.558 | -0.601 | 0.507 | -0.313 | -0.203 | 0.317 | 0.897 |
| Fish | 0.545 | 0.188 | -1.930 | 0.167 | -0.465 | 0.181 | 0.113 | 0.100 | 1.101 |
| Dairy | -0.524 | -0.839 | 0.660 | -1.759 | 0.559 | 0.209 | 0.850 | -0.121 | 0.964 |
| Bakery | -0.379 | 0.307 | -0.670 | 0.246 | -0.532 | 0.215 | 0.198 | -0.165 | 0.780 |
| Fruitnut | -0.163 | -0.188 | 0.374 | 0.106 | 0.231 | -0.964 | -0.284 | 0.088 | 0.800 |
| Sugar | -0.765 | -0.177 | 0.295 | 0.522 | 0.262 | -0.403 | -0.746 | 0.056 | 0.957 |
| Fast food | -0.522 | 0.615 | 0.575 | -0.162 | -0.563 | 0.257 | 0.137 | -1.204 | 0.867 |


|  | Prince Edward Island |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Veggies | Meat | Fish | Dairy | Bakery | Fruitnut | Sugar | Restaurant | Income el. |
| Veggies | -0.700 | 0.061 | 0.577 | -0.174 | -0.338 | -0.170 | -0.400 | -0.129 | 1.272 |
| Meat | 0.263 | -1.443 | 0.620 | -0.668 | 0.563 | -0.348 | -0.225 | 0.352 | 0.885 |
| Fish | 0.640 | 0.221 | -2.092 | 0.196 | -0.545 | 0.212 | 0.133 | 0.117 | 1.118 |
| Dairy | -0.548 | -0.876 | 0.690 | -1.793 | 0.584 | 0.218 | 0.889 | -0.126 | 0.963 |
| Bakery | -0.359 | 0.290 | -0.634 | 0.233 | -0.557 | 0.204 | 0.187 | -0.156 | 0.792 |
| Fruitnut | -0.153 | -0.176 | 0.351 | 0.100 | 0.216 | -0.966 | -0.266 | 0.082 | 0.812 |
| Sugar | -0.849 | -0.197 | 0.327 | 0.579 | 0.290 | -0.448 | -0.718 | 0.062 | 0.952 |
| Fast food | -0.522 | 0.615 | 0.574 | -0.162 | -0.563 | 0.257 | 0.137 | -1.204 | 0.867 |



Quebec


| Meat | 0.240 | $\mathbf{- 1 . 4 0 5}$ | 0.567 | -0.611 | 0.515 | -0.318 | -0.206 | 0.322 | $\mathbf{0 . 8 9 5}$ |
| :--- | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| Fish | 0.665 | 0.229 | $\mathbf{- 2 . 1 3 4}$ | 0.203 | -0.566 | 0.221 | 0.138 | 0.122 | $\mathbf{1 . 1 2 3}$ |
| Dairy | $\mathbf{- 0 . 5 8 9}$ | -0.942 | 0.741 | $\mathbf{- 1 . 8 5 2}$ | $\mathbf{0 . 6 2 7}$ | 0.235 | $\mathbf{0 . 9 5 5}$ | -0.136 | $\mathbf{0 . 9 6 0}$ |
| Bakery | -0.382 | 0.309 | -0.674 | 0.248 | $\mathbf{- 0 . 5 2 9}$ | 0.217 | 0.199 | $\mathbf{- 0 . 1 6 6}$ | $\mathbf{0 . 7 7 8}$ |
| Fruitnut | -0.161 | $\mathbf{- 0 . 1 8 5}$ | 0.369 | 0.105 | 0.228 | $\mathbf{- 0 . 9 6 5}$ | -0.280 | 0.087 | $\mathbf{0 . 8 0 3}$ |
| Sugar | -0.777 | -0.180 | $\mathbf{0 . 2 9 9}$ | 0.530 | 0.266 | -0.409 | $\mathbf{- 0 . 7 4 2}$ | 0.057 | $\mathbf{0 . 9 5 6}$ |
| Fast food | -0.536 | 0.632 | 0.590 | -0.166 | -0.578 | 0.264 | 0.140 | $\mathbf{- 1 . 2 0 9}$ | $\mathbf{0 . 8 6 4}$ |

Veggies
Meat
Fish
Dairy
Bakery
Fruitnut
Sugar
Restaurant

Vegaies Meat Ontario

| Veggies | Meat | Fish | Dairy | Bakery | Fruitnut | Sugar | Restaurant | Income el. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| -0.724 | 0.056 | 0.531 | -0.160 | -0.311 | -0.156 | -0.368 | -0.119 | 1.250 |
| 0.237 | -1.400 | 0.560 | -0.603 | 0.508 | -0.314 | -0.203 | 0.318 | 0.896 |
| 0.697 | 0.240 | -2.188 | 0.213 | -0.593 | 0.231 | 0.144 | 0.127 | 1.129 |
| -0.548 | -0.876 | 0.689 | -1.792 | 0.583 | 0.218 | 0.888 | -0.126 | 0.963 |
| -0.411 | 0.332 | -0.725 | 0.266 | -0.493 | 0.233 | 0.214 | -0.178 | 0.762 |
| -0.150 | -0.173 | 0.345 | 0.098 | 0.213 | -0.967 | -0.262 | 0.081 | 0.816 |
| -0.777 | -0.180 | 0.299 | 0.530 | 0.266 | -0.410 | -0.741 | 0.057 | 0.956 |
| -0.545 | 0.642 | 0.600 | -0.169 | -0.588 | 0.269 | 0.143 | -1.213 | 0.862 |

Manitoba

|  | Veggies | Meat | Fish | Dairy | Bakery | Fruitnut | Sugar | Restaurant | Income el. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Veggies | -0.662 | 0.069 | 0.649 | -0.196 | -0.381 | -0.191 | -0.450 | -0.145 | 1.307 |
| Meat | 0.255 | -1.430 | 0.602 | -0.649 | 0.547 | -0.337 | -0.219 | 0.342 | 0.888 |
| Fish | 0.568 | 0.196 | -1.969 | 0.174 | -0.484 | 0.188 | 0.118 | 0.104 | 1.105 |
| Dairy | -0.786 | -1.258 | 0.990 | -2.137 | 0.838 | 0.313 | 1.275 | -0.181 | 0.946 |
| Bakery | -0.375 | 0.303 | -0.662 | 0.243 | -0.537 | 0.213 | 0.196 | -0.163 | 0.782 |
| Fruitnut | -0.146 | -0.169 | 0.335 | 0.095 | 0.207 | -0.968 | -0.254 | 0.079 | 0.821 |
| Sugar | -0.793 | -0.184 | 0.305 | 0.541 | 0.271 | -0.418 | -0.736 | 0.058 | 0.955 |
| Fast food | -0.448 | 0.528 | 0.493 | -0.139 | -0.483 | 0.221 | 0.117 | -1.175 | 0.886 |



| Fruitnut | -0.148 | -0.171 | 0.340 | 0.096 | 0.210 | -0.967 | -0.258 | 0.080 | $\mathbf{0 . 8 1 8}$ |
| :--- | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| Sugar | -0.703 | -0.163 | $\mathbf{0 . 2 7 1}$ | 0.480 | 0.240 | -0.371 | -0.766 | 0.052 | $\mathbf{0 . 9 6 0}$ |
| Fast food | -0.460 | 0.542 | 0.506 | -0.143 | -0.496 | 0.227 | 0.121 | $\mathbf{- 1 . 1 7 9}$ | $\mathbf{0 . 8 8 3}$ |


| Alberta |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Veggies | Meat | Fish | Dairy | Bakery | Fruitnut | Sugar | Restaurant | Income el. |
| Veggies | -0.727 | 0.055 | 0.524 | -0.158 | -0.307 | -0.154 | -0.363 | -0.117 | 1.247 |
| Meat | 0.246 | -1.415 | 0.580 | -0.625 | 0.527 | -0.325 | -0.211 | 0.330 | 0.893 |
| Fish | 0.656 | 0.226 | -2.118 | 0.200 | -0.558 | 0.217 | 0.136 | 0.120 | 1.121 |
| Dairy | -0.710 | -1.135 | 0.893 | -2.027 | 0.756 | 0.283 | 1.151 | -0.163 | 0.952 |
| Bakery | -0.410 | 0.332 | -0.724 | 0.266 | -0.494 | 0.233 | 0.214 | -0.178 | 0.762 |
| Fruitnut | -0.148 | -0.170 | 0.339 | 0.097 | 0.209 | -0.968 | -0.258 | 0.080 | 0.819 |
| Sugar | -0.768 | -0.178 | 0.296 | 0.524 | 0.263 | -0.405 | -0.744 | 0.056 | 0.957 |
| Fast food | -0.569 | 0.671 | 0.626 | -0.176 | -0.614 | 0.280 | 0.149 | -1.222 | 0.855 |


|  | British Columbia |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Veggies | Meat | Fish | Dairy | Bakery | Fruitnut | Sugar | Restaurant | Income el. |
| Veggies | -0.735 | 0.054 | 0.510 | -0.153 | -0.299 | -0.150 | -0.353 | -0.114 | 1.240 |
| Meat | 0.232 | -1.391 | 0.547 | -0.589 | 0.497 | -0.306 | -0.198 | 0.311 | 0.899 |
| Fish | 0.713 | 0.246 | -2.216 | 0.218 | -0.607 | 0.237 | 0.148 | 0.130 | 1.132 |
| Dairy | -0.617 | -0.986 | 0.776 | -1.892 | 0.657 | 0.246 | 1.000 | -0.142 | 0.958 |
| Bakery | -0.450 | 0.364 | -0.794 | 0.292 | -0.444 | 0.255 | 0.235 | -0.196 | 0.739 |
| Fruitnut | -0.148 | -0.170 | 0.339 | 0.096 | 0.209 | -0.968 | -0.257 | 0.080 | 0.819 |
| Sugar | -0.776 | -0.180 | 0.299 | 0.530 | 0.265 | -0.409 | -0.742 | 0.057 | 0.956 |
| Fast food | -0.456 | 0.537 | 0.502 | -0.141 | -0.492 | 0.225 | 0.119 | -1.178 | 0.884 |

*Highlighted estimates are significant at the $5 \%$ level


[^0]:    ${ }^{1}$ Principal authorship is not assigned. Authors are grateful to UBC-Hampton Grant for providing funds to conduct this research.

