Fast-food Consumption and the Ban on Advertising Targeting Children: The Quebec Experience[1]

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Abstract

With growing concerns about childhood obesity and the associated health risks, several countries are considering banning advertising directed at the children. In this paper we study the effect of a ban on advertizing to children imposed in the Canadian province of Quebec in 1980 on fastfood purchase propensity and expenditures. Fastfood is not only one of the most highly advertised product categories but also is asociated with obesity, particularly among children. Using data from the Canadian food expenditure survey from 1984 to 1992, we ask whether fast food expenditure is lower in those groups affected by the ban compared to those who are not. We use a triple difference-in-difference methodology, noting that Anglophone households, due to their access to media outside the province, are less likely to be affected by the ban than Francophone households. We also use French and English-speaking households in Ontario, and households without children in both provinces, as control groups. We find evidence that the ban reduced fast food expenditure, leading to between 11 and 22 million fewer fast food meals eaten per year, which losely translates to 2.2 to 4.4 billion fewer calories consumed. As a robustness check, we use the matching estimator developed by Abadie and Imbens (2006) and find the estimates to be consistent with the initial estimates using difference in difference methodology. To the best of our knowledge, this is the first study to explore the effect of advertising ban on this specific expenditure.

Keywords: Advertising regulation, fastfood, obesity, difference in difference estimator, matching estimator.

1 Introduction

Childhood obesity is a growing problem, and governments in different countries are considering a variety of policy solutions, including banning advertisements on "so-called" junk food. Obesity puts children and adolescents at risk for a range of health ailments resulting in cardiovascular problems, diabetes, and depression (Krebs and Jacobson, 2003), making obesity second only to smoking as a cause of preventable death (McGinnis and Foerge, 1993; Allison et al 1999). A number of countries have responded by proposing sweeping restrictions on food advertising targeting children. In February 2007, the UK banned junk food advertisements to children, and in 2008, in a report to Congress, the U.S. Federal Trade Commission recommended that companies limit advertising to children to healthier food products (Federal Trade Commission 2008). Advertising can influence levels of obesity in two ways: by encouraging the consumption of unhealthy food, and by increasing advertising-supported TV programing and an associated sedentary lifestyle.[1] Various forms of advertising bans already exist in some jurisdictions, such as in the province of Quebec in Canada, along with similar bans in Sweden, Norway and Greece (only for toys). 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 that based on behavioral studies that such 'kidfluence' can effect household consumption, and that advertising targeting children is effective in altering consumption choices (Institute of Medicine, 2006).[2] In this paper, we use a quasi-experimental setup and household-level data to ask whether the Quebec advertising ban had an effect on consumption of fast-food. . Note that a better understanding of this linkage is the first step in developing a better understanding of the complex linkage between advertising, consumption and health related problems.

Advertising targeting children has always been a contentious social policy issue. Social psychologists have argued that advertising can have a harmful influence on children's consumption decisions (Singer and Singer, 2001), leading the American Psychology Association to support a

[1] For more details: 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.

[2] For more details on global regulatory environment and changes please refer to Hawkes (2004).

policy in favor of strict regulations and restrictions of advertising targeting children under the age of eight.[3] Similar concerns that children were not able to rationally process advertising led the Quebec government to introduce the Quebec Consumer Protection Act in 1980, which bans advertising targeting children under the age of 13.[4] Under this law, products and programs are rated according to their appeal to children, and products such as toys and fast-food for children cannot be advertised during children's programs in television, newspapers, magazines and in any other media targeting children.

Although the Quebec law is widely referenced by both opponents and proponents of advertising bans, very little research has been conducted on the effect of the ban. Goldberg (1990) is the first published paper to analyze impact of the ban using a quasi experiment. He uses language spoken by the children at home to identify effect of the ban on consumption behavior. He notes that the English-speaking (hereafter Anglophone or AP) children in Quebec have more access than their French-speaking (hereafter Francophone or FP) counterparts to media from outside of Quebec, and are therefore, less likely to be effected by the ban. Interviewing children in Quebec, he finds that AP children have stronger toy brand recognition than FP children. Further, he shows that AP children with access to television from the United States could correctly identify more toys and had a larger number of cereal brands targeting children in their homes. Goldberg concludes that the law was successful in reducing children's exposure to cereals and toys and, therefore, in reducing the pressure from children on their parents to buy them. However, he does not look at the effect of the ban on actual consumption patterns. Further, he only compares FP and AP children within Quebec and, as a result, if the difference in brand recognition is due to unobserved cultural factors then the effect may not be correctly identified. We overcome this problem by comparing household level consumption behavior in Quebec with comparable households in the neighboring province of

[3] For details please refer to http://www.apa.org/releases/childrenads.html

[4] As with the current proposed bans, the Quebec law was not without controversy. In one of the most famous free speech cases in Canada, the law was challenged in *Irwin Toy vs. Province of Quebec*, resulting in the Supreme Court of Canada upholding the ban in 1989, arguing that if children could not effectively analyse advertisements, then advertisements to children are inherently misleading. Debate around the ban continues. 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.

Ontario. Also, rather than using quasi experimental setup we use field level survey data to conduct natural experiment.

Besides Goldberg, most proponents of the ban refer to the literature based on the behavioral methodologies in marketing and child psychology using laboratory experiments (for comprehensive reviews see McGinnis et al. 2006 and Hastings et al., 2003). The literature in these two areas generally finds strong evidence that product promotion to children encourages the consumption of unhealthy food. One weakness of behavioral research in this context is that controlled behavior in the laboratories may not be replicated in the real world thereby questioning the external validity of the research.

Compared to the existing studies, our goal in this paper is to study the impact of advertising ban using household-level field data. Specifically, we choose fast-food as the product category to measure the impact of this ban. Our choice of the product is driven by the following factors. First, fast-food. consumption is on the increase. From 1977 to 1996, calorie intake from fast-food. restaurants doubled as a percentage of energy intake for Americans over the age of two (Nielson et al. 2002). Second, fast-food. is linked with increased caloric consumption and higher rates of obesity (Satia et al, 2005; Bowman and Vineyard, 2004, Niemeyer et al. 2006, Paeratakul et al. 2003). For example, one study of 11-18 years old found that regular fast-food. consumption was associated with ingesting an extra 800 calories per week for boys and 660 extra calories per week in girls (French et al. 2001). These extra calories translate into a possible weight gain of 10 pounds or more per year. Further, a study of Mexican children in San Diego found that 4-7 years old who ate at fast-food. restaurants were twice as likely to be obese compared to those who did not (Duerksen et al., 2007). Third, fast-food. is also one of the most advertised product category targeting children and according to some recent studies such advertising is effective in changing behavior (Institute of Medicine, 2006; Connor, 2006). Taveras et al. (2006) show that in the United States, children who view fast-food television advertisements are about 50% more likely to eat fast-food. This implies advertising plays a critical role in influencing household consumption decisions and thereby health outcomes.

To test the effect of the ban, we explore differences in expenditure on fast-food, comparing households in Quebec to households in the neighboring province of Ontario. Methodologically, we rely on the literature of treatment effect measurement. The advertising ban is the treatment and we identify a treatment group, i.e. those who are affected by the ban, and control groups, i.e. those who are not affected by the ban. Following Goldberg (1990), we use language as a primary variable to distinguish treatment and control groups, but rather than just measuring the effect within Quebec as in Goldberg, we compare households across different geographic locations and compositions, such as: fast-food consumptions in households with and without children.

We use Statistics Canada's detailed household level expenditure data over four years for the purpose of this study. This approach is a distinct departure from existing studies measuring the effect of advertising regulations that are primarily based on cross sectional surveys, experiments or use country-level data. Combining data from the annual Canadian household expenditure survey and Canada food expenditure survey (Foodex) survey from 1984, 1986, 1990 to 1992, we ask whether consumption of fast-food changed due to the ban. To the best of our knowledge, this is the first formal study to explore the impact of the Quebec law on household expenditure using field level consumption data. This will also be one of the first study to study of regulation of advertising targeting children using field level data.

To ensure that our findings are robust, we use both parametric and semi-parametric statistical techniques to estimate the effect. In this paper we first use triple difference-in-difference regression technique to estimate the effect of the ban. As a robustness check, we then estimate the effect using alternative matching approach developed in Abadie and Imbens (2006). Specifically, we first test whether the level of fast-food expenditure is significantly different for FP and AP households (hereafter FPHH and APHH) inside Quebec compared to FPHH and APHH in Ontario, and then comparing households with children to those without across APHH and FPHH.[5] We also consider whether the ban continues to affect the consumption patterns of young adults who grew up under the ban and who are now exposed to advertising. After controlling for individual level differences

[5]Similar triple difference in difference approach has been used by Gruber (1994) to study the effect of maternity benefits.

our results imply significant effect of the ban in terms of lower fast-food consumption. Interestingly, the main source of the effect is in terms of the number of purchase occasions and not in terms of amount spent on each purchase occasion. In other words, effected households spend less on fast-food per week because they went out less for fast-food than spending less on each occasion.

2 Background

On April 30, 1980, the Quebec Consumer Protection Act came into force, banning advertising targeting children under the age of 13. The law applies to both print and electronic media, although debate and enforcement of the law has mainly focused on television. Article 248 and 249 of the Act explains the law and criteria that must be used to determine whether an advertisement targets children. These include:

a. The nature and intended purpose of the products 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 television programs where children comprise more than 15 percent of the audience, advertisements targeting children, or a mix of children and adults, are not permitted. During programs where children are more than 5 percent of the viewers, advertisements directed specifically at children cannot be broadcast. Note that the law does not ban all advertising to children. Advertisements targeting children can still be broadcast during children's programs as long as they are non-commercial (such as public-service announcements) and products and services targeting adults. Thus, ads for cars or detergents are allowed during children's shows. Similarly, advertising exclusively targeting children can still be broadcast, but only during programs that are primarily watched by adults (Caron, 1994). Thus, fast-food chains like McDonald's can still advertise during late night shows but not during afternoon cartoons. Data on viewing levels and audience composition is compiled by the Bureau of Broadcast Measurement (BBM Canada) and are used to determine the nature of the program. Advertisements must be cleared with l'Office de la Protection

du Consommateur (the Consumer Protection Office) of Quebec before being broadcast.

How well the ban has been enforced can certainly be questioned. Anecdotal evidence shows active enforcement exists. 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 because it involved a known and well-liked children's character (Government of Canada and Gouvernement du Quebec, 1985). In another case, for example, in early 2007, the baked-goods producer Vachon sent promotion material to Quebec day-care centres which consumer advocates argued was in violation of the advertising ban (Kucharsky, 2007). This promotional activity resulted in the Quebec government levying the first fines under the Act in its almost 30 year history.

In terms of the effect on Quebec's advertising market, depending on the source, the net loss from TV advertising is estimated to be between $3.9 - $8.2 million per year (Caron, 1994). Anecdotal information suggests that in some cases, firms with products targeting children stopped developing advertising for children, although there is no evidence of firms exiting from Quebec due to this ban.[6] One of the weaknesses with the legislation is that it only applies to media originating inside Quebec. Thus, the ban does not apply to signals originating from the neighboring Canadian province of Ontario and the United States.

According to Caron, before the imposition of the ban, FP children spent only 6% to 7% of their viewing time on English language programming and this proportion remained the same during the period of his study until 1992. Conversely, Caron notes that Anglophone children spent a large amount of time watching English broadcasts largely originating from the United States. We use the language-specific viewing patterns to identify the effect of the ban.

3 Database and Estimation Strategy

We use data from the household-level expenditure survey (Famex) and food expenditure survey (Foodex) from Statistics Canada. The Canada Foodex survey has detailed information on bi-weekly

[6] For further details please refer to Rapport du Comite Federal-Provincial sur la Publicite Destine aux enfants, Sept. 1985.

food purchase behavior of households. Both surveys have been conducted periodically since 1972 and are large. For example, in 1996, the Foodex survey had household information and detailed food expenditure data for over 10,900 families, while the Famex surveyed 5,600 households. In this paper, our focus is on *meals at fast-food. restaurants* as the listed expenditure category in the Foodex surveys. The *Foodex* survey contains detailed information on expenditure on fast-food per week, the number and type of restaurant meals purchased (i.e., breakfast, lunch or dinner). The *Famex* survey contains detailed information on expenditure on entertainment including cable television subscription. We use this survey data to control for television availability within the households, as television is one of the most important advertising reaching children.

For the purpose of this research, both pre and post ban expenditure data would have been ideal. Unfortunately, Foodex survey data prior to 1984 is not available for research, implying we do not observe consumption behavior before the ban. Instead, we use data from the 1984, 1986, 1990 and 1992 surveys for the purpose of our research and cross sectionally compare households in defined treatment and control areas. Note that one of the determinants of treatment group, mother tongue, is only recorded in surveys prior to 1996, so we cannot use data from more recent surveys for our analysis. The four years mentioned are also the years when both Foodex and Famex surveys were conducted during the same year. To keep the sample representative, we deleted the 5 out of 40205 households with fast-food expenditure of more than \$150/per week, which is 40 times more than the weekly average household expenditure[7]. We also dropped the 94 households with no food expenditures. The four years of data year are stacked, creating a pooled data set. We chose only the neighboring province of Ontario as a control for Quebec because the two provinces have similar economic and socio-demographic characteristics. Population-weighted summary statistics for households with children across two provinces are presented in Table 1. Over most demographic characteristics, including age, household composition and occupation, the household groups are quite similar. In fact simple t-test of means of demographic characteristics we consider suggest no significant differences.

[7]Retaining these households in our sample did not substantively change our results.

In terms of mother tongue of the households, we classify them into four types: FPHH, where both spouses are French speaking, APHH, where both spouses are English speaking, Allophones, where both spouses speak neither English nor French, and mixed households, where spouses have different mother tongues. We drop mixed households as previous research and anecdotal evidence do not provide any guidance in terms of their consumption behavior. Both the *Foodex* and *Famex* survey also contain detailed household characteristics, such as mother tongue of the household head and the spouse, education level, whether the family owns its home or rents, level and sources of income, and occupation (which we classified as white collar, blue collar or manufacturing and construction, pink collar or service sector, and none given).

Our estimation strategy follows the literature on treatment effects in economics. Given that we do not have data before the imposition of the ban, we instead compare households cross-sectionally by carefully defining the treatment and control groups. Madrian (1994) uses a similar cross-sectional approach to identify treatment effect when considering the link between job mobility and health care benefits. We define the treatment and control in three dimensions to estimate the effect of the ban:

[1] *By Province.* The ban applies to the province of Quebec but not to Ontario. If the ban is effective, there should be lower consumption of fast-food in Quebec than in Ontario after controlling for socio-demographic differences. In this case, we define the treatment group as households living in Quebec who come under the purview of the ban and Ontario households as control group, who are outside the ban's jurisdiction.

[2] *By Language.* Because FPHH primarily get their media from Quebec-based French sources, while APHH tend to use English media from outside the province, we would expect FPHH to spend significantly less on fast-food than APHH in Quebec if the ban is effective. Further, if media consumption habits of APHH in Quebec and Ontario are similar, we expect that there should not be a significant difference in expenditure between APHH in the two provinces. Similarly, FPHH in Ontario are exposed to media mainly originating in Ontario, and therefore, their expenditures will be closer to the APHH households and different from FPHH in Quebec. One of the problems

defining control and treatment groups only in Quebec as in Goldberg (1990) is that we would not be able to control for any unobservable cultural differences influencing fast-food consumption between the FPHH and APHH in Quebec. So, we compare consumption in Quebec with similar households from the neighboring province of Ontario. The effectiveness of the ban will imply the difference between FPHH and APHH in Quebec is larger than the difference between FPHH and APHH in Ontario.

[3] *By Children.* Note that the nature of the ban implies households with children will be affected more than the households without children. And among the households with children, FPHH households with children in Quebec will be the most affected if the ban is effective. So, if we create eight groups (i.e. *two provinces* $\times$ *two languages* $\times$ *two types of households*) then the difference between the FPHH and APHH with children in Quebec will be larger than the equivalent difference in households in Ontario, and larger than the difference of FPHH and APHH without children.

Figure 1 presents fast-food expenditures per week by household locations and types. Note that in the case of all households, on average households in Quebec spend less than the households in Ontario. And the differences are larger in the case of households with children than for households without children. Of all the cases, the largest and significant ($p < 0.01$) difference is between FPHH and APHH with children in Quebec. If the ban is effective, we would expect this difference to be significantly larger than any differences between unaffected groups, such as in APHH and FPHH without children, or similar households with children in Ontario. Figure 1 also plots averages for households with only positive fast-food expenditures in the survey. For the FPHH, the difference between groups decreases once we drop households with zero expenditures but on the other hand for the APHH households the differences reverse such that Ontario APHH spend more than Quebec APHH. This implies our analysis should not only take into account expenditure levels but also decisions to purchase by the households.

Our approach is to estimate the differences across these eight groups in expenditure and purchase occasions after controlling for all available socio- demographic factors. As previously mentioned,

one factor that can affect consumption is exposure to media, particularly television viewing. None of the available databases have detailed information on household level television viewing patterns. Of the available databases, only the biannual Canadian household expenditure survey (i.e. Famex) provides information on detailed yearly expenditure on cable and satellite TV subscriptions, but no information on viewing pattern is available. Another estimation challenge is that since the Foodex and Famex surveys are conducted on different samples, we cannot directly infer access to television by the households in the Foodex data. So, we project the television ownership from Famex to Foodex data by using the following approach: by year and by province, we estimate a probit model of cable television ownership as a function of household characteristics and sampling weights using Famex data and then using the same set of characteristics and sampling weights in the Foodex files we predict the probability of cable television subscription. A further problem is that prior to 1990, the Famex survey only provides information on household expenditure on the broader category of 'household entertainment' which includes cable and internet subscriptions, along with movie tickets. To address this problem, we use the 1990 data to estimate both the probability of cable expenditure and the joint probability of household entertainment expenditure and no cable expenditure as a function of demographic characteristics. We next estimate the probability of household entertainment expenditure for 1986 and 1982, and then predict the joint probability of household entertainment expenditure and no cable expenditure using the coefficients from the probit model estimates using 1990 data. We generate an estimate for cable expenditure for 1986 and 1982 by subtracting the joint probability from the probability for household entertainment expenditure. In 1992, 65% of Canadian households in our database paid for cable television.[8] So, our proxy for television ownership will most likely be an underestimate.

Another challenge we face is in terms of prices, especially for households who do not purchase fast-food. Given that we only have the quantity of meals, separated into the number of breakfasts, lunches and dinners for all restaurant purchases, we divide total weekly expenditure by the number of meals where fast-food was the only type of restaurant visited by a household in a given week.

[8] Our data also noted whether a renter received cable for free. These houesholds were included as having access to cable.

Specifically, we first find the median price for fast-food breakfasts, lunches and dinners by province and by year, by taking the expenditure for those households who only purchased one type of restaurant meal in a week, and divide by the number and type of meals they bought. We then weight the quantity of breakfasts, lunches and dinners by the provincial yearly average for fast-food. , and take weighted average of prices. We use this price as the price facing households with zero fast-food expenditure.

4 Estimation

To measure the extent of differences across groups in fast-food expenditures, we first use a modified difference-in-difference technique with a Heckman (1979) selection model. To check the robustness of this approach we use a matched estimation technique developed by Abadie and Imbens (2006). The first approach is parametric in nature and the second approach is semi-parametric. Given the methodological differences we expect the estimated mean effect to be different from these two approaches but we expect the qualitative results to be robust.

4.1 Difference-in-Difference Approach

The use of difference-in-difference to estimate the average effect of treatment has a long history in the labour and development economics literature (for example, see Ashenfelter and Card, 1985; Lalonde, 1986; Card and Krueger, 1996). The concept is quite simple; one measures the effect of a policy by comparing changes in behavior or outcome in the treated group to that of a control group before and after the policy was implemented. As long as the control group households are similar to treatment group households, the control group captures any average effect of change in secular outcome over time, isolating the effect of the treatment. In its simplest form, the estimated coefficient of the interaction dummy variables between treatment group and dummy for the period after the treatment captures the net effect of the treatment:

$$y = z_k'\beta_k + \beta_g g + \beta_p p + \delta g \times p + v \tag{1}$$

where y is the outcome variable. g is a dummy variable such that it is 1 if observations belong to a subject in the treatment group and not from the control group. Similarly p is a dummy variable such that it takes the value 1 if the observation is from the treatment period 2 and not from the period 1. Lastly, z is a vector of k characteristics or covariates and the associated vector of coefficients β_k represent the effect of the individual characteristics on the outcome. The coefficient β_g represents the effect of other differences between the treatment and control groups, β_p represents the average effect on both treatment and control groups of the policy introduction and capturing possible spillover effects or the effect of unobserved variables whose change coincided with the introduction of the policy. The coefficient on the interaction term, δ, represents the average effect of the policy on the treatment group such that $\delta = \left(\overline{y}_{A,2} - \overline{y}_{A,1}\right) - \left(\overline{y}_{B,2} - \overline{y}_{B,1}\right)$. The last term, ν is the error term.

Our formulation is slightly different in that we do not have data before the ban. However, given the richness of the database, we can tease out the net effects of the ban by defining treatment and control groups in different dimensions: [1] in terms of demographics; the ban affects Francophone households more than Anglophone households in Quebec because of their media consumption behavior. [2] We note that households without children, whether in Quebec or in Ontario, should not be affected by the ban. [3] The spatial dimension the ban implies that only households in Quebec and not the neighboring province of Ontario are affected. So, we can define Quebec as the treatment region and Ontario as the control region. Thus, for our regression, the variable p in equation 1 does not represent the time the ban was introduced, but the groups most affected by the ban, such as FPHH with children inside Quebec. We specify fast-food expenditure as a function of:

$$\begin{aligned} FF = z_k'\beta_k + \beta_{FP}FPHH + \beta_{OP}OPHH + \beta_{FPQC}FPHH \times QC \times C \\ +\beta_{APQC}APHH \times QC \times C + \beta_{OPQC}OPHH \times QC \times C \\ +\beta_{FPOC}FPHH \times ON \times C + \beta_{APOC}APHH \times ON \times C \\ +\beta_{OPQC}OPHH \times ON \times C + \beta_{FPQNC}FPHH \times QC \times NC \\ +\beta_{APQNC}APHH \times QC \times NC + \beta_{OPQNC}OPHH \times QC \times NC \\ +\beta_{FPONC}FPHH \times ON \times NC + \beta_{APONC}APHH \times ON \times NC \\ +\beta_{OPONC}OPHH \times ON \times NC \end{aligned} \tag{2}$$

Note: here ON : Ontario, QC : Quebec, C : households with children, NC: households without

children

Our critical treatment group is FPHH with children living in Quebec. Broadly, we are interested in determining how much less fast-food FPHH in Quebec consume than FPHH in Ontario, compared to the difference between APHH in Quebec versus in Ontario. Further, since it is only households with children that are affected by the ban, we measure the triple difference-in-difference, looking at how much less FPHH with children spend in Quebec versus Ontario, compared to APHH in Quebec versus Ontario, compared to same difference-in-difference for households without children. To measure and decompose these differences we can rewrite equation 2:

$$\begin{aligned} NFF \equiv FF - z_k'\beta_k = \beta_{FP}FPHH + \beta_{OP}OPHH + \beta_{FPQC}FPHH \times QC \times C \\ +\beta_{APQC}APHH \times QC \times C + \beta_{OPQC}OPHH \times QC \times C \\ +\beta_{FPOC}FPHH \times ON \times C + \beta_{APOC}APHH \times ON \times C \\ +\beta_{OPQC}OPHH \times ON \times C + \beta_{FPQNC}FPHH \times QC \times NC \\ +\beta_{APQNC}APHH \times QC \times NC + \beta_{OPQNC}OPHH \times QC \times NC \\ +\beta_{FPONC}FPHH \times ON \times NC + \beta_{APONC}APHH \times ON \times NC \\ +\beta_{OPONC}OPHH \times ON \times NC \end{aligned} \tag{3}$$

Here NFF is the fast-food expenditure after netting out any variations in expenditure across households due to covariates. The average difference in fast-food expenditures across provinces for FPHH with children can be expressed as $\left(\beta_{FPQC} - \beta_{FPOC}\right) = \overline{NFF}_{FPQC} - \overline{NFF}_{FPOC}$, where $\overline{NFF}_{FPQC}$ and $\overline{NFF}_{FPOC}$ are the average fast-food expenditures by FPHH with children in Quebec and Ontario. This difference will be negative if the ban is effective. Similarly for APHH we can estimate the difference as: $\left(\beta_{APQC} - \beta_{APOC}\right) = \overline{NFF}_{APQC} - \overline{NFF}_{APOC}$. Following Goldberg we do not expect APHH in Quebec to be as affected by the ban as FPHH. Subtracting the two effects leads us to a difference in difference estimates between FPHH and APHH with children in Quebec and Ontario: $\left(\beta_{FPQC} - \beta_{FPOC}\right) - \left(\beta_{APQC} - \beta_{APOC}\right)$. A significant negative difference implies expenditure differences on fast-food by FPHH with children in Quebec cannot be explained by location or by mother tongue after controlling for other covariates.

However, it is still possible that APHH and FPHH in Quebec behave differently than from households in Ontario, and that these differences are not symmetric across the two language groups due to composition of the households. Since the ban is only expected to affect households with children, we also use households without children as a further control for these cultural and lifestyles dif-

ferences. The difference between fast-food consumption of households without children in Quebec and Ontario is $(\beta_{FPQNC} - \beta_{FPONC}) - (\beta_{APQNC} - \beta_{APONC})$, and is expected to be close to zero because the ban should not affect the behavior of consumers without children. Now we can net out the joint language-province differences for all households estimating a triple difference in difference estimator by subtracting the second difference in difference from the first. Thus, the triple difference-in-difference estimate will represent an effect that is specific to Francophone households with children in Quebec, and is over and above the effect on Anglophone households with children in Quebec, and nets out unobservable influences on consumption affecting households without children or households in Ontario. If the ban is effective then we would expect this estimated triple difference will be significantly different from zero and negative.

4.2 Heckman Model and Results

To estimate the equation 2, we face the challenge that not all households consume fast-food in any given week, and as a result, we have a prevalence of zeros in the weekly fast-food expenditure data. Also, from figure 1 we know that purchase decisions influences average expenditure measure. Therefore, we use a Heckman two-stage approach (Heckman 1976). The approach assumes a latent variable, y_i^*, is a function of the right-hand variables, but that y_i^* is not always observed. Specifically, y_i^* is observed only if the decision, d_i is made and decision is a function of various characteristics, z_i (called the selection equation):

$$\begin{gathered} y_i^* = z_i\beta + v_i \\ y_i = y_i^* \quad \text{if } d_i = x_i\gamma + u_i > 0 \\ = 0 \quad \text{if } \; d_i = x_i\gamma + u_i \leq 0 \\ \text{where } (u, v) \tilde{} n(0, 0, \sigma_u, \sigma_v, \rho) \\ \text{Note that } v|u \tilde{} n(\rho\sigma_v u, \sigma_v^2(1-\rho^2)) \end{gathered} \tag{4}$$

The linear estimation is generally not independent of the selection process. The error terms are assumed to have a joint normal distribution, with means of 0 and correlation of ρ. Thus, the expectation of the error term in the linear regression conditional on y_i being observed is not mean zero, and a standard regression ignoring selection would produce biased estimates. To correct for this problem, the selection equation is used to generate an inverse mills ratio (IMR), which

represents the expected value of the error term given y is observed for each individual, to correct for the selection bias in the linear regression.

$$\begin{aligned} E(y_i|u_i > -x_i\gamma) &= z_i'\beta + \rho\sigma_v E(u_i|u_i > -x_i\gamma) \\ E(y_i|u_i > -x_i\gamma) &= z_i'\beta + \rho\sigma_v \tfrac{\phi(-x_i\gamma)}{\Phi(x_i\gamma)} \end{aligned} \tag{5}$$

where Φ and ϕ are the CDF and PDF, respectively, associated with the probability of observing a censored outcome. In the Heckman approach, we use maximum likelihood to estimate the first stage probit model on whether households purchase fast-food or not in a given week. The estimated probit model is then used to generate the IMR, represented as the last term in the above equation to control for the selection bias when estimating of the amount of expenditure. Effectively, the IMR represents the omitted variables from the selection process that also affect the amount of expenditure (Heckman 1979). This first stage probit model is identified due to exclusion of a variable that affects selection but does not affect the choice of expenditure after the decision to purchase has been made. Specifically, we use a dummy for whether both spouses are recent immigrants, under the assumption that recent immigrants are less likely to purchase fast-food purely due to different preferences, and less familiarity with fast-food.[9] Our treatment and control variables are included in both the selection and linear regressions. Because the log of non-zero expenditure data closely approximates a normal distribution, we estimate the natural log of expenditure.

Results show that the error terms in the selection and linear regressions are not independent, and therefore, the inverse mills ratio needs to be included.[10] Note that the variables included in both selection and linear regression often have different (and significant) signs, implying that a tobit specification would be too restrictive in this case.[11]

We use the estimated interaction variables to estimate the difference in difference effect. In the case of first stage of the decision process, we present the coefficients and the marginal effects estimated at the mean for the probit selection equation.[12]

[9] We also tried using the education level of the male head of household as the exclusion variable, which was found to influence the decision to purchase fast food, but not the amount purchased, and the results were qualitatively the same.

[10] Specifically, the correlation between the error terms, ρ, is significantly different from zero at the 4 percent level.

[11] For example, higher female education singificantly increases the probability that a household will purchase fast food, but decreases the amount spent.

[12] For continuous variables defined as:

Table 2 presents the parameter estimates of both the selection and expenditure equations. To estimate how much of these differences we can attribute to the ban, we compare the difference between FPHH with children in Quebec and Ontario, to the difference between APHH in Quebec and Ontario, compared to those same differences without children. We use households in the rest of Canada as a base. The difference-in-difference results are presented in Table 3. The effect of the ban can be seen by noting the much larger difference in probability to purchase between FPHH in Quebec and Ontario, compared to APHH in Quebec versus Ontario. As can be seen in the first row, first column, FPHH with children living in Quebec are 12.3 percent less likely to consume fast-food that their Ontario counterparts. APHH with children in Quebec are 6 percent less likely to purchase fast-food than their Ontario counterparts, although this result is not significantly different from zero. FPHH without children are not significantly less likely to purchase fast-food in Quebec compared to those in Ontario, and are no different than their APHH counterparts. Thus, there is a significant difference between the probability of purchasing fast-food by FPHH in the two provinces compared to APHH in the two provinces for households with children, while there is no significant difference for households without children. These results indicate that the main effect of the ban is to decrease the probability that households go to fast-food restaurants. The ban appears to primarily affect FPHH, not non-FPHH (i.e. APHH and OPHH). Households that speak neither French nor English as their primary mother tongue are less likely to go to fast-food restaurants when they live in Quebec, regardless of whether they have children or not. Thus, non-native English or French speakers seem to be less likely to purchase fast-food. in Quebec, period. Whether this is a result of being exposed to less media in Quebec, or because the group is fundamentally different than their Ontario counterparts is in question.

There is some evidence that the ban may reduce the amount spent once households went for fast-food, for example, FPHH with children spend 52 percent less in Quebec than in Ontario, and this difference is much larger than the same amount for APHH with children, who spend 25 percent

$$\tau_k = \frac{\partial E(d_i)}{\partial z_{ik}} = \phi\left(z\gamma\right)\frac{\partial z\gamma}{\partial z_k} \tag{6}$$

For dummy variables, we give the effect of moving from 0 to 1.

less in Quebec, or for FPHH without children, who spend only 4 percent less. That said, the triple difference-in-difference is not significantly different than zero, so it appears that the primary effect of the ban was on whether to purchase at all, not how much to spend once the family decided to purchase fast-food. .

In terms of access to cable television, we tested whether the probability of having cable television was correlated with the probability of purchasing fast-food. . We find that in general, households with access to cable are 12 percent more likely to purchase fast-food. . Further, households with children and cable are a further 5 percent more likely purchase fast-food. . Most interesting, however, is that households with cable and children in Quebec are an additional 13 percent more likely to purchase fast-food. compared to their counterparts in other provinces. This finding is consistent with our difference-in-difference results, showing greater access to media from outside the province increases the probability of purchasing fast-food. .

Other results of interest in the selection equation are that men and women with white collar jobs are more likely to purchase fast-food (the one exception being women with pink collar jobs who were more likely than their white-collar counterparts to purchase fast-food.). However, once having decided to purchase fast-food. , households with white collar women spend less. We see a similar result with education, where both male and female education increases the probability to purchase, while female education decreases the expenditure. Households where both spouses are working full-time are slightly more likely to purchase fast-food, and to spend more when they do, but the higher income they had, the less likely they are to purchase fast-food. , and less they spend. One might expect double-income households to spend more on fast-food. given their time constraints. However, higher-income families may be substituting into higher-quality restaurant take-out food instead of buying burgers and fries. Having a higher income increases the probability of purchase, but at a decreasing rate. Last, households tend to spend less, and purchase less often as the age of the respondent increases. Note that in the case of selection equation only two of the estimates out of 12 are insignificant. On the other hand, only three of the interaction dummy estimates in the expenditure equations are significant. This difference suggests that the key difference across

households is in terms of purchase occasions and not amount spent.

To check whether we are observing an overall effect on food expenditure, we run the same regression for total household food expenditure.[13] Households with children spend slightly more for food in Quebec than in Ontario. Although that difference is slightly larger for APHH than FPHH with children, the same pattern appears to be true for households without children, and the triple-difference result of 0.005, or 1/2 of one percent, is not significantly different from zero (with a p-stat of 0.96). Regression result related to total food expenditure is presented in the appendix.

5 Matched Estimates

To check for the robustness of the estimates and our key findings, we also estimate the affect of the ban using a matching technique. Under this method, the treatment effect for a single unit, τ_i is defined as the difference between the outcome of a household that was in the treatment group minus the outcome if that same family was untreated $y_i(1) - y_i(0)$. In our case, the treatment effect is the difference in fast-food. expenditure between a Quebec household affected by the ban and that of same households if they were in Ontario. So, if we could observe the treatment and non-treatment outcome for the same household - i.e. both $y_i(1)$ and $y_i(0)$, then the effect of the treatment on household i would simply be the difference. The problem is that for each household, we only observe either the outcome of treatment or not. Thus, following Imbens et al.:

$$y_i = y_i(T_i) = \begin{cases} y_i(0) & \text{if } T_i = 0 \\ y_i(1) & \text{if } T_i = 1 \end{cases} \tag{7}$$

where T_i represents whether treatment is received by household i ($T_i = 1$) or not ($T_i = 0$).

We are specifically interested in the sample average treatment effect: $\delta = \frac{1}{N}\sum_{i=1}^{N}(y_i(1) - y_i(0))$. Note that in the present study, only one of the potential outcomes $y_i(0)$ or $y_i(1)$ is observed for each households and the other is unobserved or missing. We impute the missing potential outcome

[13] One difference in the specification is that because all families have some food expenditure, we do not control for selection. A second difference is that to control for quality preferences, we control for the type of store where the food was purchased (be it a convenience, grocery or specialty shop).

by using average outcomes for individuals with "similar" values for the covariates. Let,

$$\hat{y}_i(0) = \begin{cases} y_i \quad if \ T_i = 0, \\ \frac{1}{M(i)} \sum_{l \in M(i)} y_l \quad if \quad T_i = 1 \end{cases} \tag{8}$$

$$\hat{y}_i(1) = \begin{cases} y_i \quad if \ T_i = 1, \\ \frac{1}{M(i)} \sum_{l \in M(i)} y_l \quad if \quad T_i = 0 \end{cases} \tag{9}$$

where $M(i)$ is the number of matched households for household i. Following Abadie and Imbens, we set the number of matched households to four. We can restate the matching estimator as:

$$\delta_M = \frac{1}{N} \sum_{i=1}^{N} \left(\widehat{y}_i(1) - \widehat{y}_i(0) \right) \tag{10}$$

Intuitively, if the treated and control units systematically differ in their characteristics, then we cannot disentangle the effect of the characteristics from the effect of the treatment. Such bias is of paramount concern in non-experimental studies. So, to refine the estimation process we also adjust the estimates for biases. With bias corrections the treatment effect becomes: $\delta_M = \frac{1}{N} \sum_{i=1}^{N} \left(\widetilde{y}_i(1) - \widetilde{y}_i(0) \right)$

where: $\widetilde{y}_i(0) = \begin{cases} y_i \quad if \ T_i=0, \\ \frac{1}{M(i)} \sum_{l \in M(i)} y_l + (\widehat{p}_0(Z_i) - \widehat{p}_0(Z_l)) \quad if \quad T_i=1 \end{cases}$ and $\widetilde{y}_i(1) = \begin{cases} y_i \quad if \ T_i=1, \\ \frac{1}{M(i)} \sum_{l \in M(i)} y_l + (\widehat{p}_1(Z_i) - \widehat{p}_1(Z_l)) \quad if \quad T_i=0 \end{cases}$

where $\widehat{p}_0$ is the prediction function based linear regression of covariates on group outcomes. Finally, the averages are adjusted for population weights. And given the potential problem of heterogeneity, we use robust standard errors to estimate significance.

To keep the matching estimates comparable to the estimates using the Heckman approach, we use same the set of covariates from the Heckman approach for the purpose of matching households. We also add fast-food purchase decision as one of the matching variables. Further, we use the explanatory dummy variables from the Heckman analysis for exactly matching the households and for bias corrections. Matching results are presented in Table 4A and 4B. To focus on the critical differences here we only present the differences between FP and AP households. Again note that using matched estimation approach we can only estimate the difference between two groups at a time. So, first we compare households across provinces (i.e. Table 4A) and then within provinces (i.e. Table 4B).

Comparing across provinces, if we take into account both purchasing and non-purchasing households then Quebec households spend \$3.85 ($p < 0.01$) less than Ontario households. Note that in this case we add language and purchasing decisions as two of the variables for exact matching. Next if we consider only the households with positive expenditures then we find Quebec households spend \$0.61 less but this amount is insignificant. Comparison of these two estimates suggest that the key difference in expenditure is in terms of purchase occasions. Next, we estimate the differences for households with and without children for all households. Again in both case we find significant differences: in the case of households with children Quebec households spend \$4.35 ($p < 0.01$) less and in the case of households without children they spend \$1.45 ($p < 0.01$) less. Interestingly if we only consider households with positive fast-food expenditures then only in the case of households with children we find significant difference. This result suggests that Quebec households with children not only purchase fast-food less often but spend less when they do.

Next, we compare households within provinces (Table 4B). In the case of Quebec, if we consider all households, we find significant differences between APHH and FPHH; and FPHH spend \$0.52 ($p < 0.01$) less than the APHH. Again, if we only consider households with positive fast-food expenditures, then the difference becomes insignificant. Next we estimate the differences between FPHH and APHH with children in Quebec. In this case, FPHH spend \$2.83 ($p < 0.01$) less than the APHH and if we consider households with positive expenditures then this difference becomes \$6.35 ($p < 0.01$). On the other hand, if we consider households without children then difference decreases to \$0.03 and this is insignificant ($p > 0.01$). Interestingly, if we consider households without children but with positive expenditures then the difference is significant but positive with an average difference of \$1.63 ($p < 0.01$). This estimate suggests FPHH without children, contrary to all other comparisons conducted, spend more than comparable APHH. In general, we find that FPHH with children in Quebec not only went out less for fast-food but spent less than other comparison groups. Finally, we compare groups within Ontario. In this case not only are the differences between FPHH and APHH small, but they are also insignificant. This finding clearly conforms to the argument that in a market where the ban was not imposed the households will

show no difference in expenditures.

Overall, we find the differences in expenditures similar to the Heckman results. In most cases the difference is due to differences in purchase incidence across provinces and across households. We find significant differences in expenditures between FPHH and APHH households with children in Quebec. This difference becomes insignificant if we compare households in Ontario, suggesting that FPHH and APHH do not show any difference in expenditures if they are unaffected by the ban. We also find that compared to any other groups, FPHH with children in Quebec not only shopped less of fast-food but also spent less. In the case of households without children, we do not find any significant difference in Quebec but interestingly the difference become significant if we consider only households with positive expenditures. On the other hand, we do not find any significant differences between households without children in Ontario.

5.1 Persistence

One of the particular concerns about children's advertising is that it may not only influence concurrent consumption, but that it may set patterns of consumption behavior for the future. We consider whether the effect of the ban affects purchasing patterns as children age past 13, and are exposed to advertisements in Quebec. Here we run into another set of data constraints. We are limited by the fact that the data on mother tongue only continues until 1992, and therefore, we can only consider those households who were affected by the ban when it was first imposed. Second, we do not have specific data on the age of children in the household, so we cannot consider households with teenagers over 15 separate from households with multiple adults. Therefore, we consider fast-food. expenditure of households composed of individuals less than 25 years of age in 1992, i.e. consumers who were targeted by the ban when it was imposed, and compare them to households composed of individuals more than 35 years of age, i.e. consumers who were not targeted by the ban in 1980. Third, we only have the specific age of the individual who answered the questionnaire and their spouse, so we limit ourselves here to households of one or two members, where the young adult is less likely to be responding for his or her aging parents or extended family. Since the overall results using Heckman approach imply that the ban primarily decreased

the probability that Francophone households purchased fast-food. , we focus on the persistence of how the ban affected decision to purchase fast-food for Francophone under the age of 25 (i.e. young adults). Fourth, we do not have specific information on where households lived previously, so our analysis here implicitly assumes that the majority of the young population has remained in the same province. We compare the probability of purchase between young Francophones and Anglophones living in Quebec and Ontario to their older counterparts. Results are presented in Table 5. Because of the aforementioned data constraints, the number of observation in regression analysis is 4600, with only one tenth of those being under the age of 25.

Our results suggest that people under the age of 25 are more likely to purchase fast-food. than older households, and this finding appears to hold whether the young adult is FP or AP. However, young FP adults are more likely to purchase fast-food. if they lived in Ontario than if they lived in Quebec, whereas the reverse is true for young AP. A FP young adult is 38 percent less likely to have purchased fast-food. if (s)he lived in Quebec versus Ontario, while a similar AP young adult is 24 percent more likely to purchase fast-food. in Quebec. The resulting difference in difference is a large 63 percent, and is significantly different from zero at the five percent level. Comparing the younger adults to their older counterparts, both groups of older adults are more likely to purchase fast-food. if they live in Ontario than in Quebec, and this difference is smaller than that for the young adults. Therefore, we see a large triple difference-in-difference effect, which, although not significantly different from zero, provides an indication that the effect of the advertising ban on children does affect purchasing behavior as those children become adults.

5.2 Estimated Effects

Given that the ban had a statistically-significant effect at the household level, here we estimate the total effect of the ban. We first calculate the expected loss in revenue to fast-food. from the ban based on the parameter estimates by the Heckman approach. First, consider if FPHH with children in Quebec would behave like their Ontario counterparts if the ban were removed. In that case, they would be 12.3 percent more likely to consume fast-food. within a week without the ban. Given that the average amount spent per household when the household consumed was $13.04 per week, this

amounts to an expected increase of $83.40 per year per household. Based on the sampling weights, we estimate that 0.43 million Francophone households with children in Quebec in our sample who do not consume fast-food. in any given week and assuming that the increase the probability of purchase by 12.3% only effect these households, then that would lead to an expected increase of $35. 7 million in fast-food. sales in Quebec per year without the ad ban.

However, we know that FPHH without children are also less likely to purchase fast-food. in Quebec than they are in Ontario. If we assume this difference is unrelated to the ban and net out this effect, then we can say that the ban caused a 9.3 percent drop in the probability of purchasing fast-food. . Using the same numbers as above, this amount translates to an annual drop of $ 27 million in fast-food. sales caused by the ban. Last, our analysis suggest that that along with households without children, APHH with children in Quebec were not significantly affected by the ban, and use the triple difference-in-difference as our measure of the effect of the ad ban, then the ban caused a drop of 7.1 percent in the probability of purchase. This percentage reduction implies that the ban caused a drop of $20. 6 million in revenue per year. This last estimation can be thought of as a lower-bound on the effect, since one might believe that APHH in Quebec would at least be affected by the lack of in-store promotion to children, and watch some of the English programing originating inside the province that is affected by the ban.

Next, let us compare these estimates from our Heckman approach to estimates based on the matching technique. From the matching results, we find that in the first instance, FPHH with children in Quebec spend an average of $2.83 per week less than their APHH neighbors, while in Ontario this difference is only $0.11 and not significantly different from zero. So, if we consider only the significant difference then the effect of the ban was of $88.3 million based on our estimated 0.6 million FPHH with children in Quebec. We also estimate that the average difference in expenditure between FPHH and APHH is $0.52 where we use having children and number of children as one of the matching variable. If we take this estimate and calculate the total decrease in fast-food expenditures then Quebec then that measure will be $16.1 million. Note that this number is close to the lower bound estimates using Heckman approach.

Lastly, what do these results mean in terms of calories consumed? Given that an average fast-food. meal costs about $3.90 in our sample, this amount translates to approximately 11 to 22 million fewer fast-food. meals consumed due to the ban. With 800-1100 calories per meal, that means that households in Quebec consumed between 9 to 23 billion fewer fast-food. calories per year due to the ban. In two separate studies, consumers eating a fast-food. meal were found to consume more than 200 calories more than if they ate elsewhere (Paeratakul et al, 2003; Bowman and Vinyard 2004). Recognizing that these studies were done on US adults, if we assume that Quebec consumption patterns are otherwise similar to those in the United States, we find that the ban reduced net calorie consumption by 2.2 to 4.4 billion per year.

6 Concluding Remarks

Advertising targeting children has become a major cause for concern for policy makers in a number of countries. The primary reason for concern is the belief that advertising has increased fast-food consumption and is related to the exponential increase in obesity among children . Several countries are responding by considering banning advertisements of unhealthy food to children. One jurisdiction that has a ban on all children-specific advertising is the province of Quebec in Canada. In this paper, we study the effect of this ban on fast-food expenditure by households in Quebec.

We identify the effect of the ban by noting that if the ban is effective, given the nature of media market and demographic composition, it will affect French-speaking families more than English-speakers in Quebec and will not affect similar households in Ontario or those without children in either province. We find that Francophone households are significantly less likely to purchase fast-food. if they lived in Quebec than in Ontario and, on average, they end up spending significantly less. On the other hand, for Anglophone households with children we do not find significant differences between Quebec and Ontario. We then use a triple difference in difference estimator to control for location, cultural and demographic specific idiosyncrasies between French and English households in these two provinces and still find that French households in Quebec are significantly less likely than the other households to purchase fast-food. . For readers concerned

that inherent cultural differences affect attitude and preferences for fast-food. , and may cause the difference between French and English consumption, we also estimate difference in difference estimator between French and English households without children, and find a much smaller and insignificant difference, both in terms of purchase occurrence and the amount spent. This result suggest that significantly lower purchase probabilities and smaller expenditure by French families with children cannot be due to cultural differences in preference for fast-food. We then estimate triple difference in difference to estimate differences in expenditure between French and English households with and without children, living in either Quebec or Ontario. This estimate not only controls for household locations (i.e. Quebec vs. Ontario) but also in terms of having children, a critical factor of the ban having an effect. Again in this case we find significant difference in the number of purchase occasions but not in terms of the amount purchased. This result implies French households with children in Quebec spent less on fast-food after controlling for similar households within and across provinces and this is due to lower purchase occasions than the other groups we considered. As a last check, we compare our results on this highly-advertised food category against food expenditures in general, and we find no evidence that the advertising ban had any effect on total food expenditure.

As a robustness check we estimate the differences across households using matched estimation approach. We match households by various demographic characteristics across Quebec and Ontario, for households with children and those without, and find that households with children living in Quebec spend significantly less on fast-food. than their Ontario counterparts. Once we compare within provinces, then again we find that French households spend significantly less than English families in Quebec. These differences disappear once we compare households within Ontario.

Based on the estimated differences in expenditure and probability of purchasing fast-food, we find that Quebec households spent approximately $88 million to $16 million less on fast-food depending on assumptions we make on the groups significantly effected by the ban. The magnitude of the estimates suggest that the effect of the ban is non-trivial. Estimates of the magnitude of the effect range from a decrease of 11 to 22 million fast-food. meals per year due to the ban. This

amount translates into 2.2 to 4.4 billion decrease in net caloric consumption per year.

Last, we find some weak evidence that the effect of the ban persists as the children become young adults. We look at expenditure by people 25 and under in Quebec versus Ontario in 1992 and find that FPHH in Quebec are still less likely to purchase fast-food. compared to their counterparts in Ontario and to their APHH counterparts. Further, the difference-in-difference is larger for those 25 and under than it is for those 35 and older, although this triple difference-in-difference estimate is not significantly different from zero.

In terms of policy implications, the present study provides evidence that a ban on advertising targeting children can be effective in lowering or moderating consumption, and approximate estimates of the total difference in expenditures do suggest the social welfare impact of such ban can be significant. One may ask, given this finding should other jurisdictions in Canada, or other countries implement similar bans. Here our results suggest that one should be cautious. Our results show that it is primarily the FP children who were effected by this ban, while AP children who had better access of media from the neighboring US states and Canadian provinces were less affected, if at all. Thus, the media spillover can blunt the effect of such ban. Therefore, a ban imposed by a single state or province by itself may not be effective if there is substantial media overlap, and advertising regulations are likely to be more effective if several jurisdictions can coordinate efforts. Also, with rapid change in information technology where as children are spending more and more time on video games and computers, any attempt to impose a similar ban will be challenging. Interestingly consumer advocates in Quebec currently are using the ban to pursue internet advertising.[14] It will be interesting to see whether they can expand the effective scope of the ban to address these new media.

In terms of shortcomings, in this paper we only look into the effect of the ban on consumption. Due to existing data limitations and estimation challenges we do not provide evidence of the link between consumption and health outcomes. Again due to data limitations we were not able to explore the long term effect of such ban. In the future we plan to extend and explore these further

[14] Specifically, the Societe pur la provention des poids in Quebec are challenging Lucky Charms and others that advertise internet games on their food packaging.

links.

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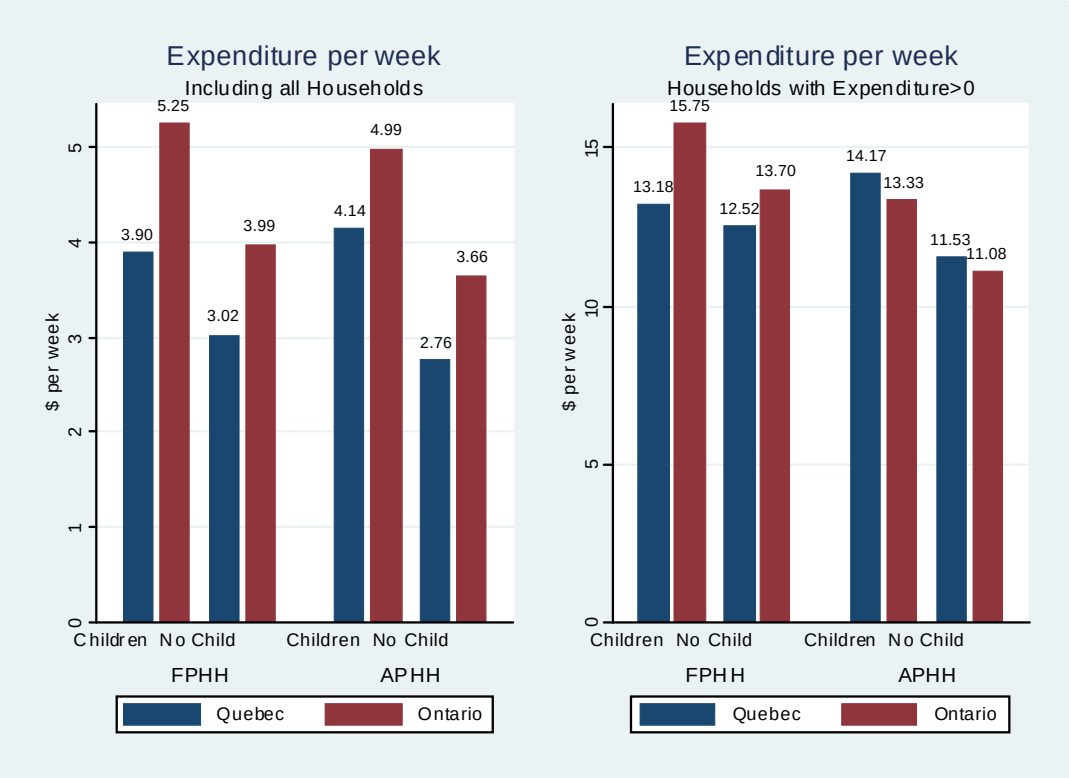

Figure 1: Fast-food Expenditure per Week

Table 1: Summary statistics for families with children

	French		English	
	Quebec	Ontario	Quebec	Ontario
Total food expenditure ($/week)	130.89	129.42	129.09	130.40
	(2.08)	(7.65)	(4.71)	(2.13)
Number of children	1.64	1.71	1.91	1.69
	(0.02)	(0.09)	(0.07)	(0.02)
Income	4.35	4.56	3.96	5.29
	(0.06)	(0.28)	(0.21)	(0.08)
Dummy: Double-income household	0.34	0.26	0.41	0.37
	(0.01)	(0.04)	(0.04)	(0.01)
Dummy: Immigrant household	0.01	0.05	0.14	0.10
	(0.01)	(0.02)	(0.03)	(0.01)
Male education	2.56	2.40	2.84	2.77
	(0.04)	(0.15)	(0.14)	(0.04)
Female education	2.61	2.35	3.19	2.99
	(0.03)	(0.12)	(0.11)	(0.03)
Male occupation: Blue collar	0.12	0.15	0.13	0.13
	(0.01)	(0.03)	(0.03)	(0.01)
Male occupation: Service Sector	0.18	0.22	0.14	0.13
	(0.01)	(0.04)	(0.03)	(0.01)
Female occupation: Blue collar	0.02	0.01	0.03	0.02
	(0.01)	(0.01)	(0.01)	(0.01)
Female occupation: Service Sector	0.31	0.32	0.22	0.31
	(0.01)	(0.04)	(0.03)	(0.01)
Age of respondent	37.26	37.19	37.77	37.02
	(0.19)	(0.64)	(0.58)	(0.18)

Table 2: Full Results of Selection Probit Equation and Regression of Log of Expenditure on Fast Food

	Selection Equation	**Expenditure Equation**
	marginal effect	coefficient
Interaction Dummies		
FPHH with children in Quebec	-0.244^{c} (τ_{FPQC})	-0.341^{a} (β_{FPQC})
APHH with children in Quebec	-0.096^{a} (τ_{APQC})	-0.191 (β_{APQC})
OPHH with children in Quebec	-0.193^{c} (τ_{OPQC})	-0.578^{b} (β_{OPQC})
FPHH with children in Ontario	-0.121^{c} (τ_{FPOC})	-0.194 (β_{FPOC})
APHH with children in Ontario	-0.034^{b} (τ_{APOC})	0.056 (β_{APOC})
OPHH with children in Ontario	-0.059^{c} (τ_{OPOC})	-0.078 (β_{OPOC})
FPHH without children in Quebec	-0.171^{c} (τ_{FPQNC})	0.071 (β_{FPQNC})
APHH without children in Quebec	-0.029 (τ_{APQNC})	0.027 (β_{APQNC})
OPHH without children in Quebec	-0.117^{c} (τ_{OPQNC})	-0.069^{b} (β_{OPQNC})
FPHH without children in Ontario	-0.141^{c} (τ_{FPONC})	0.194 (β_{FPONC})
APHH without children in Ontario	0.010 (τ_{APONC})	0.056 (β_{APONC})
OPHH without children in Ontario	0.004 (τ_{OPONC})	-0.099 (β_{OPONC})

	Selection Equation		**Expenditure Equation**
	coefficient	marginal effect	coefficient
Rest of the Covariates			
Dummy: FPHH (APHH as base)	0.173^{b}	0.062	0.008
Dummy: OPHH	-0.017	-0.006	0.135^{c}
Number of Children (age 0 to 5)	-0.181^{c}	-0.064	0.086^{c}
Number of Children (age 5 to 15)	-0.061	-0.021	0.097
Probability of Cable	0.347^{c}	0.122	0.237^{b}
Probability of Cable TV × children	0.153^{c}	0.054	-0.028
Probability of Cable TV × children × Quebec	0.367^{a}	0.129	0.418^{a}
Unit Price of Fast Food	-8.500^{c}	-0.225	0.408^{c}
(Unit Price of Fast Food)^{2}	1.057		-0.012^{c}
Number of Household Members	0.022^{b}	0.008	0.034^{c}
Dummy:Blue Collar Male Occupation** (White Collar as base)	-0.091^{c}	-0.031	0.082^{b}
Dummy: Pink Collar Male Occupation**	-0.087^{c}	-0.030	0.045

Table 2: Results of Selection Probit Equation and Regression of Log of Expenditure on Fast Food, cont'd.

	Selection		**log of Expenditure**
	Coefficients	marginal effect	Coefficients
Dummy: No Male Occupation**	-0.075^c	-0.026	0.029
Dummy: Blue Collar Female Occupation**	-0.156^b	-0.053	0.149
Dummy: Pink Collar Female Occupation**	0.049^b	0.017	0.085^c
Dummy: No Female Occupation**	-0.060^b	-0.021	0.085^c
Dummy: Home Owner**	0.047^b	0.016	-0.057^b
Dummy: Recipient of Social Assistance**	-0.197^c	-0.066	-0.055
Male Education***	0.059^c	0.021	0.034^c
Female Education***	0.015^b	0.005	-0.041^c
Dummy: Age of Household head	-0.015^c	-0.006	-0.003^c
Dummy: Dual Income Household	0.044	-0.038	0.098^a
Dummy: Dual Income Household $*$ Income	-1.417^a		-0.891
Dummy: Both Spouses Immigrants	-0.139^c	-0.048	
Income	5.604^c	4.274	0.400
(Income)^2	-13.402^b		13.157^b
Dummy: Year 1986	0.437	0.161^c	0.057^a
Dummy: Year 1990	0.420	0.154^c	0.108^c
Dummy: Year 1992	0.448	0.164^c	0.192^c
Dummy: 1st Quarter	0.095	0.034^c	-0.062^b
Dummy: 2nd Quarter	0.072	0.026^c	0.009
Dummy: 3rd Quarter	0.139	0.050^c	0.047^a
Constant	16.135	4.968^c	0.381^c

a indicates significantly different from 0 at the 10% level, b at the 5% level and c at the 1% level. ** Dummy variables, where White collar is defined as managerial, professional or teaching; Blue collar is defined as Farming, Fishing, Forestry, Mining, Processing, Manufacturing or Construction. Pink collar is defined as Clerical, Sales or Service. *** The education variable is defined as follows: 1 = less than 9 years; 2 = some secondary; 3 = some post-secondary; 4 = post-secondary certificate; 5 = university degree. Those with missing education were dropped.

Table 3: Difference-in-difference results comparing families with children in Quebec and Ontario

		Selection	**Log of Expenditure**
		Marginal effects	Coefficients
Difference in Households FF expenditure with children [Quebec vs. Ontario]			
[1]	FPHH with Children $(\tau_{FPQC} - \tau_{FPOC})$, $(\beta_{FPQC} - \beta_{FPOC})$	-0.123^{c}	-0.535^{b}
[2]	APHH with Children $(\tau_{APQC} - \tau_{APOC})$, $(\beta_{APQC} - \beta_{APOC})$	-0.062	-0.247
[3]	OPHH with Children $(\tau_{OPQC} - \tau_{OPOC})$, $(\beta_{OPQC} - \beta_{OPOC})$	-0.133^{c}	-0.500^{b}
Difference-in-difference (Comparison of households with children across Provinces)			
[4]	FPHH vs. APHH with Children [1] − [2]	-0.061^{b}	-0.288^{a}
[5]	OPHH vs. APHH with Children [3] − [2]	-0.072^{b}	-0.253
Households without children [Quebec vs. Ontario]			
[6]	FPHH without Children $(\beta_{FPQNC} - \beta_{FPONC})$	-0.030	-0.039
[7]	APHH without Children $(\beta_{APQNC} - \beta_{APONC})$	-0.040	0.105
[8]	OPHH without Children $(\beta_{OPQNC} - \beta_{OPONC})$	-0.120^{c}	0.030
Difference-in-difference (Comparison of households without children across Provinces)			
[9]	FPHH vs. APHH without Children [6] − [7]	0.010	-0.143
[10]	OPHH vs. APHH without Children [8] − [7]	-0.081^{b}	-0.075
Triple difference-in-difference (Comparison of Households across provinces with and without children)			
[11]	FPHH vs. APHH with and without children across provinces [4] − [9]	-0.071^{a}	-0.129
[12]	OPHH vs. APHH with and without children across provinces [5] − [10]	0.009	-0.156

Note: a indicates significantly different from 0 at the 10% confidence level, b at the 5% level and c at the 1% level.

Table 4A: Across Province Comparison

	Estimates
Quebec vs. Ontario	-3.85
	0.00
Quebec vs. Ontario with Children	-4.35
	0.00
Quebec vs. Ontario without Children	-1.45
	0.00
With Positive Fastfood Expenditure	
Quebec vs. Ontario	0.61
	0.09
Quebec vs. Ontario with Children	-2.21
	0.00
Quebec vs. Ontario without Children	0.38
	0.36

Table 4B: Within Province Comparison

	Estimates	
	Within Quebec	**Within Ontario**
FPHH vs. APHH	-0.52	-0.24
	0.00	*0.40*
FPHH vs. APHH with Children	-2.83	-0.11
	0.00	*0.85*
FPHH vs. APHH without Children	-0.03	0.37
	0.91	*0.12*
Within Quebec with Positive FF Exp.		
FPHH vs. APHH	-0.99	-0.73
	0.16	*0.34*
FPHH vs. APHH with Children	-6.37	0.17
	0.00	*0.92*
FPHH vs. APHH without Children	1.63	0.24
	0.01	*0.77*

Note: Underlined numbers are the estimated differences in expenditures and italicized numbers are the corresponding significance level.

Table 5: Probit on fast-food. expenditure of households 25 and under and those 35 and over.

	Under 26		**Over 35**	
	marginal effect	std. err.	marginal effect	std. err.
FPHH in Quebec	0.057	0.072	-0.068[a]	0.042
APHH in Quebec	0.248	0.186	0.057	0.082
FPHH in Ontario*	0.444[b]	0.040	0.096	0.096
APHH in Ontario*	0.004	0.068	0.134[c]	0.037
Difference				
FP Quebec vs. Ontario	-0.387	0.255	-0.165[a]	0.085
AP Quebec vs. Ontario	0.244	0.185	-0.076	0.081
Difference-in-difference				
French vs. English, Quebec vs. Ontario	-0.631[b]	0.309	-0.088	0.094
Triple difference-in-difference				
25 and under vs. over 35, French vs. English Quebec vs. Ontario*	-0.542	0.339		

Appendix A: Results on Total Food Expenditure

		Log of Expenditure
		Coefficients (std. err.)
Difference in Households FF expenditure with children [Quebec vs. Ontario]		
[1]	FPHH with Children $(\tau_{FPQC} - \tau_{FPOC})$, $(\beta_{FPQC} - \beta_{FPOC})$	0.122 (0.095)
[2]	APHH with Children $(\tau_{APQC} - \tau_{APOC})$, $(\beta_{APQC} - \beta_{APOC})$	0.249[b] (0.092)
[3]	OPHH with Children $(\tau_{OPQC} - \tau_{OPOC})$, $(\beta_{OPQC} - \beta_{OPOC})$	0.194 (0.103)
Difference-in-difference (Comparison of households with children across Provinces)		
[4]	FPHH vs. APHH with Children [1] − [2]	−0.127 (0.074)
[5]	OPHH vs. APHH with Children [3] − [2]	−0.054 (0.074)
Households without children [Quebec vs. Ontario]		
[6]	FPHH without Children $(\beta_{FPQNC} - \beta_{FPONC})$	−0.076 (0.048)
[7]	APHH without Children $(\beta_{APQNC} - \beta_{APONC})$	0.046 (0.035)
[8]	OPHH without Children $(\beta_{OPQNC} - \beta_{OPONC})$	−0.006 (0.034)
Difference-in-difference (Comparison of households without children across Provinces)		
[9]	FPHH vs. APHH without Children [6] − [7]	−0.122[b] (0.059)
[10]	OPHH vs. APHH without Children [8] − [7]	0.052 (0.059)
Triple difference-in-difference (Comparison of Households across provinces with and without children)		
[11]	FPHH vs. APHH with and without children across provinces [4] − [9]	−0.005 (0.095)
[12]	OPHH vs. APHH with and without children across provinces [5] − [10]	−0.106 (0.093)