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Fast-Food Consumption and the Ban on Advertising Targeting Children: The Quebec Experience

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Amid growing concerns about childhood obesity and the associated health risks, several countries are considering banning fast-food advertising targeting children. In this article, the authors study the effect of such a ban in the Canadian province of Quebec. Using household expenditure survey data from 1984 to 1992, authors examine whether expenditure on fast food is lower in those groups affected by the ban than in those that are not. The authors use a triple difference-in-difference methodology by appropriately defining treatment and control groups and find that the ban's effectiveness is not a result of the decrease in fast food expenditures per week but rather of the decrease in purchase propensity by 13% per week. Overall, the authors estimate that the ban reduced fast-food consumption by US$88 million per year. The study suggests that advertising bans can be effective provided media markets do not overlap.

Keywords: advertising regulation, fast food, obesity, difference-in-difference estimator

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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 problems such as cardiovascular disease, diabetes, and depression (Krebs and Jacobson 2003), making obesity second only to smoking as a cause of preventable death (Allison et al. 1999; McGinnis and Foege 1993). Obesity researchers have identified fast food as one of the key drivers of this problem because it significantly increases caloric consumption per meal (Bowman and Vinyard 2004; Niemeyer et al. 2006; Paeratakul et al. 2003; Satia, Galanko, and Siega-Riz 2005). For example, French et al.'s (2001) study of 11- to 18-year-olds finds that regular consumption of fast food is associated with ingesting an extra 800 calories per week for boys and 660 extra calories per week for girls. These extra calories translate into a possible weight gain of 10 pounds or more per year. Furthermore, Duerksen et al.'s (2007) study of Mexican children in San Diego finds that 4- to 7-year-olds who ate at fast-food restaurants were twice as likely to be obese as those who did not. Indeed, from 1977 to 1996, calorie intake from fast-food restaurants has doubled as a percentage of energy intake for Americans over the age of 2 years (Nielsen, Suega-Riz, and Popkin 2003).

Fast food is also one of the most heavily advertised product categories targeting children, and according to recent studies, such advertising is effective in changing behavior (Connor 2006; Institute of Medicine of the National Academies 2006). For example, Taveras et al. (2006) show that in the United States, children who view fast-food television advertisements are approximately 50% more likely to eat fast food. Thus, advertising plays a critical role in a household's decision to consume fast food and thereby affects health outcomes. Advertising can influence obesity in two ways: by encouraging the consumption of unhealthy food

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and by increasing advertising-supported television programming and an associated sedentary lifestyle (for more details, see Boynton-Jarrett et al. 2003; Crespo et al. 2001; Dietz and Gortmaker 1985; Giammattei et al. 2003; Gortmaker et al. 1996; Halford et al. 2004; You and Nayga 2005). As a result, several countries have responded by either implementing or proposing sweeping restrictions on fast-food advertising targeting children. In February 2007, the United Kingdom banned junk-food advertising to children, and in 2008, in a report to Congress, the U.S. Federal Trade Commission recommended that companies restrict advertising to children to healthier food products (Federal Trade Commission 2008). In addition to the recent initiatives in the United Kingdom and the United States, 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. On the one hand, advertising lobby groups argue that despite the ban, children in Quebec are no less obese than children in other parts of Canada (Lister and Hurst 2004); proponents of advertising bans, on the other hand, note that behavioral studies show that "kidfluence" can affect household consumption and that advertising targeting children is effective in altering consumption choices (Institute of Medicine of the National Academies 2006; for more details on the global regulatory environment, refer to Hawkes 2007). In this article, we use a quasi-experimental setup and household-level data to examine whether the Quebec advertising ban, in force since 1980, has had an effect on consumption of fast food. A better understanding of this connection is the first step in comprehending the complex linkage between advertising, consumption, and health-related problems.

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) published the first study analyzing the impact of the ban using a quasi-experiment. He uses language spoken by children at home to identify the effect of the ban on consumption behavior, noting that 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 Quebec and are therefore less likely to be affected by the ban. Interviewing children in Quebec, he finds that AP children have stronger toy-brand recognition than FP children and, furthermore, that AP children with access to television from the United States could correctly identify more toys and have a larger number of child-targeted cereal brands in their homes. Goldberg concludes that the law is 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 consider the effect of the ban on actual consumption patterns. Moreover, he compares only FP and AP children in Quebec; as a result, if the difference in brand recognition is due to unobserved cultural factors, 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 Ontario. In our natural experimental setup, we use survey data on expenditure to analyze the effect of the ban, using the fact that the ban is applicable only in Quebec and not in Ontario.

In terms of approaches to studying advertising regulations targeting children, our article deviates from the existing studies with respect to both sources of data and estimation methods. Indeed, most proponents of advertising bans refer to the literature in marketing and child psychology (for comprehensive reviews, see Hastings et al. 2003; Institute of Medicine of the National Academies 2006). In general, the literature in this area, mainly based on laboratory experiments, finds strong evidence that product promotion to children encourages the consumption of unhealthy food. One weakness of behavioral research in this context, however, is that controlled behavior in laboratories may not be representative of behavior in the real world. Thus, concerns about the external validity of the research are warranted. In contrast to the existing studies on advertising regulation targeting children, our goal in this study is to study the impact of an advertising ban using household-level field data. Specifically, we choose fast food as the product category to measure the impact of this ban.

Because we are examining the effectiveness of the advertising ban on expenditure, our study is also a study of the effectiveness of advertising. Behavioral researchers tend to focus on the impacts of advertising on the consumer's decision process, while most empirical quantitative studies tend to focus primarily on the effectiveness of brand-level advertising (for a good review of the behavioral process literature, see Vakratsas and Ambler 1999). Early quantitative studies on advertising effectiveness mainly used highly aggregated data, at either the brand or product level, and ordinary least squares (OLS) or simultaneous equations estimation methods. Assmus, Farley, and Lehmann (1984) provide an excellent meta-analysis of the early studies. They find that these early studies have imperfect "quasi-experimental designs" and do not isolate the effect of advertising. Lodish et al. (1995) overcome some of the shortcomings Assmus et al. mention by using proprietary BehaviorScan-matched household data to estimate the effectiveness of advertising on brand-level consumption behavior. In our study, we control for household-level demographic characteristics as part of the estimation process and use three key sets demographic characteristics (location, language spoken in the household, and household composition) to identify the effect of advertising. Unlike Lodish et al., we also decompose the consumption decision into stages: decision to purchase and amount spent. Some of the recent research on advertising has concentrated more on the strategic implications of brand-level advertising, or advertising awareness, than on its effectiveness per se (e.g., Jedidi, Mela, and Gupta 1999; Naik, Mantrala, and Sawyer 1998; Steenkamp et al. 2005). As a category-level study, our research complements the recent studies on the effectiveness of advertising at the brand level.

To measure the effect of the ban, we estimate the difference in fast-food expenditure between our treatment and control groups. In the program-evaluation literature, this approach of estimating the effect of a program, or treatment, is known as a difference-in-difference (DD) estimator. The use of DD estimators has a long history in labor economics literature (see, e.g., Ashenfelter and Card 1985; Card and Krueger 1994; Lalonde 1986). In this case, the advertising ban is the treatment, and we identify a treatment group (i.e., those affected by the ban) and control groups (i.e., those not affected by the ban). Following Goldberg (1990), we use language as a primary variable to distinguish treatment and control groups, but rather than simply measuring the effect within Quebec, as Goldberg did, we compare households across different geographic locations and compositions (e.g., households with and without children). We believe this is one of the first applications of the DD method to estimate advertising effectiveness in the marketing literature.

With respect to estimation, the key challenge is that household-level consumption data do not exist for the period before the ban. To overcome this limitation, we first identify the groups highly likely to be unaffected by the ban, both within and outside Quebec, and then compare their consumption behavior with that of the group most likely to be affected. Specifically, we first test whether fast-food expenditure is significantly different for FP and AP households within Quebec than for FP and AP households in Ontario and then compare households with children with those without children.[1] 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, our results imply a significant effect of the ban in terms of lower levels of fast-food consumption. Note that the main source of the effect is in terms of the number of purchase occasions, not in terms of the amount spent per week. In other words, affected households spend less on fast food per week because they go out for fast food less often, not because they spend less on each occasion.

To estimate the effect of the advertising ban, we use Statistics Canada's detailed household-level expenditure survey data over four years. This approach is a distinct departure from existing studies measuring the effect of advertising regulations, which are primarily based on cross-sectional surveys or experiments or use country-level data.[2] Combining data from the Canadian food expenditure survey (FoodEx) and the household expenditure survey (FamEx) from 1984, 1986, 1990, and 1992, we ask whether consumption of fast food changed as a result of the ban. To the best of our knowledge, this is the first formal study to explore the impact of the Quebec law on household-level expenditure using population-representative household consumption data. Our research is also one of the first to study the regulation of advertising targeting children using field-level data.

BACKGROUND

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 policy in favor of restrictions on advertising targeting children under the age of eight years.[3] Similar concerns that children are not able to process advertising rationally and the American Psychology Association's recommendation led the Quebec government to introduce the Quebec Consumer Protection Act, which bans advertising targeting children under the age of 13 years, in 1978. The law came into effect two years later on April 30, 1980. 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 on television or in newspapers, magazines, or in any other media targeting children. The law applies to both print and electronic media, though debate and enforcement of the law have mainly focused on television. Articles 248 and 249 of the act explain the criteria used to determine whether an advertisement targets children, which include the following:

> [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 for which children constitute more than 15% of the audience, advertisements targeting either children or a mix of children and adults are not permitted. During programs for which children constitute more than 5% of viewers, advertisements directed specifically at children cannot be broadcast. Note that the law does not ban all advertising to children; advertisements can still be broadcast during children's programs, as long as they are noncommercial (e.g., public-service announcements) or are for products and services targeting adults. Thus, advertisements 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 such as McDonald's can still advertise during late-night shows, but not during afternoon cartoons. Data on viewing levels and audience composition are compiled by the Bureau of Broadcast Measurement (BBM Canada) and are used to determine the nature of the program. Advertisements must be cleared with Quebec's Office de la Protection du Consommateur (Consumer Protection Office; hereinafter, OPC) before being broadcast.[4]

How well the ban has been enforced can certainly be questioned. Anecdotal evidence suggests active enforcement of the law. For example, in 1984, McDonald's proposed a commercial in which Ronald McDonald would explain to children the importance of wearing seat belts; this commercial was refused by OPC because it involved a known and well-liked children's character (Government of Canada and Gouvernement du Quebec 1985). In another

[1]Gruber (1994) uses a similar triple difference-in-difference (DDD) approach to study the effect of maternity benefits. For an exposition of the DDD, refer to Hamermesh and Trejo (2000).

[2]Economics and marketing literature has extensively studied tobacco advertising bans. For a comprehensive review of this literature, refer to Saffer and Chaloupka (2000).

[3]For details, see http://www.apa.org/releases/childrenads.html.

[4]Similar to the current proposed bans, the Quebec law was not without controversy. In one of the most famous free speech cases in Canada, the advertising ban was challenged in *Irwin Toy v. Quebec*; the Supreme Court of Canada upheld the ban in 1989, arguing that if children cannot effectively analyze advertisements, advertisements to children are inherently misleading. Debate around the ban continues. In the August 15, 2005, issue of *Marketing Magazine*, an article titled "Time to End It?" discusses the perceived drawbacks of the ban for Quebec television programming (Kucharsky 2005). 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 repealed.

case, in early 2007, Saputo, one of the largest baked- and dairy-goods producers in Canada, sent promotional material to Quebec day care centers featuring Igor the Gorilla, the brand mascot of its baked muffin products; consumer advocates argued that the material was in violation of the advertising ban (Kucharsky 2008), and as a result, OPC successfully sued Saputo Inc. (Hamilton 2009). Similarly, Burger King was recently sued in connection with its campaign targeting children and, in the end, agreed to a fine and stopped the campaign (*The Gazette* 2009).

Depending on the source, the net loss to Quebec's advertising market from television advertising is estimated to be between \$3.9 million and \$8.2 million per year (Caron 1994). Anecdotal information suggests that in some cases, firms with products targeting children stopped developing advertising, although there is no evidence of firms exiting Quebec as a result of this ban (for further details, refer to Rapport du Comité Fédéral-Provincial sur la Publicité Destiné aux enfants [Government of Canada and Gouvernement du Quebec 1985]). One of the legislation's weaknesses is that it applies only to media originating inside Quebec, and thus the advertising ban does not apply to signals originating from the neighboring Canadian province of Ontario or from the United States. We exploit this weakness to identify the effect of the ban.

DATABASE

We use data from Statistics Canada's food expenditure survey (FoodEx), which provides detailed information on the biweekly food-purchasing behavior of households. Respondents participating in the survey keep a detailed diary of all food expenditures. In the FoodEx survey, households use a daily food expenditure diary for two weeks, recording the number and type of meals consumed and the amount spent on these meals. Statistics Canada then makes aggregated weekly files available for research. In this article, our focus is the FoodEx expenditure category meals at fast-food restaurants.[5] Finally, Statistics Canada has derived a set of household weights for use with the publicly available FoodEx data file that take into account the survey design and the nonresponse rate. When weighted, the sample is generally representative of the Canadian population. All results presented in here incorporate these weights. The equivalent survey in the United States is the Consumer Expenditure Survey conducted by the Bureau of Labor Statistics.

For the purposes of this research, both pre- and postban expenditure data would have been ideal. Unfortunately, Foodex survey data before 1984 are not available for research, meaning that we have no observations of 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 the treatment group, mother tongue, is recorded in surveys only up to 1996, so we cannot use data from more recent surveys for our analysis. We chose only the neighboring province of Ontario as a control for Quebec because the two provinces have similar economic and sociodemographic characteristics and because Ontario has a relatively large Francophone population. Because most information on television consumption behavior during the period of our study comes from urban areas, we focus our study on large urban areas in both provinces (i.e., those with a population of more than 100,000).[6] Another reason for dropping small cities and rural areas is that in more remote areas, there may be pockets of FP or AP neighborhoods in which distance and lack of transportation make fast food less available, constraining access to supply.

To keep the sample representative, we delete five households with fast-food expenditures of more than \$150 per week, which is 40 times the weekly average household expenditure. (Retaining these households in our sample did not substantively change our results.) We also drop 94 households with no food expenditure. Our final sample consists of 9177 households (5024 in Ontario and 4153 in Quebec). The four years of data year are stacked, creating a pooled data set. Table 1 presents population-weighted summary statistics for all the households in the sample. Across most demographic characteristics, including age, household composition and occupation, the comparable household groups (e.g., FP and AP households with children in Quebec) are similar.

In terms of mother tongue, we classify the households into four types: FP households, in which both spouses are French speaking; AP households, in which both spouses are English speaking; allophone households (OP), in which both spouses speak neither English nor French; and mixed households, in which spouses have different mother tongues. We dropped OP and mixed households because previous research and anecdotal evidence do not provide any guidance in terms of their media and fast-food consumption behavior. Over our time frame, unilingual AP and FP households constitute 69% and 5% of all households in Ontario and 8% and 80% of the households in Quebec, respectively. By restricting ourselves to households in which both spouses have the same mother tongue, we lose about 4% of households in Quebec and 6% of households in Ontario. When we ran the regression including bilingual households, our results were qualitatively unchanged, though the magnitudes of the effect of the ban were slightly smaller. When we included OP households, we found that they tended to have similar consumption patterns to the dominant-language group in each province. Thus, OP households in Ontario had similar consumption patterns as their AP counterparts, and OP households in Quebec largely acted like their FP neighbors.

Note that in terms of media, one of the key assumptions underlying our identification strategy is that FP children do not spend a significant amount of time watching English television channels compared with AP children. Data on viewership during the period of study are not publicly available, but on the basis of studies of Canadian television consumption behavior, we believe there is strong evidence that

[5]Statistics Canada broadly defines fast-food restaurants as places where there is no table service, only self-service, and food is provided in a minimal amount of time. In the survey questionnaire, respondents were specifically asked about their expenses at "fast-food restaurants."

[6]We are also restricted by the fact that the FoodEx and FamEx surveys only include urban households in 1984 and 1990. Therefore, we dropped households from rural areas included in the 1986 and 1992 surveys. In terms of population distribution, in 1991, 78% and 82% of the population lived in the included cities in Quebec and Ontario, respectively.

Table 1
DESCRIPTIVE STATISTICS

	Quebec				*Ontario*			
	FP With Children	*AP With Children*	*FP Without Children*	*AP Without Children*	*FP With Children*	*AP With Children*	*FP Without Children*	*AP Without Children*
Continuous Variables								
Average number of children	1.638	1.880	N.A.	N.A.	1.707	1.696	N.A.	N.A.
	.017	*.049*	N.A.	N.A.	*.070*	*.016*	N.A.	N.A.
% of households with cable television subscription	76.25	77.64	54.85	55.23	8.21	82.57	63.81	65.37
Average price of fast food	4.300	4.230	4.293	4.246	3.733	3.736	3.737	3.760
	.014	*.030*	*.008*	*.019*	*.030*	*.013*	*.019*	*.008*
Average household income (in millions of CDN$)	.043	.042	.032	.031	.050	.052	.039	.042
	.001	*.002*	*.000*	*.001*	*.003*	*.001*	*.002*	*.000*
Average household size	3.643	3.867	2.374	2.629	3.784	3.729	2.655	2.534
	.032	*.100*	*.032*	*.079*	*.098*	*.028*	*.107*	*.033*
Average male education	2.575	2.903	1.807	1.856	2.638	2.742	1.977	2.007
	.038	*.105*	*.028*	*.066*	*.114*	*.036*	*.090*	*.028*
Average female education	2.625	3.003	1.901	2.074	2.571	2.965	2.325	2.200
	.028	*.084*	*.026*	*.061*	*.091*	*.028*	*.089*	*.024*
Average age of the household head	37.380	38.046	48.533	5.580	36.981	37.137	45.923	49.160
	.186	*.441*	*.290*	*.653*	*.480*	*.168*	*.884*	*.266*
TOTFOODX ($)	131.549	14.209	88.376	92.783	135.988	131.268	101.457	96.162
	2.024	*4.624*	*1.103*	*2.645*	*6.624*	*1.963*	*3.987*	*1.136*
Discrete Variables								
% of male white-collar occupation	55.32	61.48	63.10	67.21	52.48	57.81	66.81	67.74
% of male blue-collar occupation	11.52	12.33	5.87	5.16	14.30	13.04	3.58	6.13
% of male pink-collar occupation	17.73	14.77	12.10	8.48	20.47	17.22	12.02	9.11
% of no male occupation	15.43	11.42	18.93	19.14	12.74	11.94	17.60	17.02
% of female white-collar occupation	31.68	36.93	52.92	58.30	35.68	37.48	58.84	58.31
% of female blue-collar occupation	2.41	2.36	1.34	1.73	2.49	2.01	0.35	1.32
% of female pink-collar occupation	30.75	19.25	18.16	14.75	31.92	31.55	16.51	18.45
% of no female occupation	35.16	41.46	27.58	25.22	29.91	28.95	24.30	21.93
% of households owning home	66.63	65.18	40.29	39.73	52.34	66.92	42.53	51.47
% of households under social assistance	9.59	12.20	7.81	7.59	11.67	7.82	7.85	4.09
% of dual-income household	32.77	40.15	17.91	13.07	30.98	34.84	19.99	19.27
% of immigrant households	1.35	12.86	0.82	3.84	4.06	10.67	3.93	4.27
% of observations from 1984	23.69	24.11	22.51	23.36	28.56	24.50	24.66	20.39
% of observations from 1986	24.37	31.23	23.06	27.47	13.48	21.41	17.67	23.95
% of observations from 1990	26.67	21.03	27.19	20.71	32.73	26.52	24.31	25.23
% of observations from 1992	25.27	23.63	27.23	28.46	25.22	27.58	33.36	30.43
% of observations from first quarter	24.75	25.93	25.28	22.84	22.58	27.83	27.77	23.40
% of observations from second quarter	24.26	32.48	24.31	24.71	27.32	25.35	26.74	24.33
% of observations from third quarter	26.80	18.62	23.94	27.24	25.21	24.10	23.63	26.42
% of observations from fourth quarter	24.20	22.98	26.46	25.21	24.89	22.73	21.85	25.85
Sample size	1875	292	3865	772	222	2450	438	4953
Estimated population size	2,539,828	430,989	5,715,714	1,211,994	251,954	294,3157	525,985	6,583,052

Notes: Numbers in italics are the standard deviation. We estimated population size according to population weight provided by STATCAN. N.A. = not applicable.

this is the case. In one of the most comprehensive studies of the impact of the ban on media, Caron (1994) states that before the imposition of the ban, FP children spent only 6%–7% of their viewing time on English-language programming and that this proportion remained the same after the ban. Caron also notes that AP children spent a large amount of time watching English broadcasts that largely originated from the United States. In another study using 1987 and 1993 data from Montreal—the largest city in Quebec, with 21% of the province's total population—De la Garde (1996) notes that in 1987, FP households viewed French programming 88% of the time and that close to 100% of it was supplied by Quebec-based television stations. This proportion increased to 92% in 1993. In contrast, English-speaking households spent more than 90% of their viewing time on English programming, which mainly originated from outside the province.

Recent data continue to support this argument. In 2007, Canadian-produced programs dominated the list of popular prime-time drama/comedy programs in Quebec—holding six of the top ten positions, including all top three spots. All these programs are in French, and even the non-Canadian programs are dubbed in French and transmitted by Quebec-based television stations. Note that the bias in favor of Quebec-based French television holds not only for children's programming but also for adult programming (Kelly 2009). Indeed, dissimilarity in media consumption combined with similarity in brands and other product consumption by Quebec's French-speaking consumers is turning Quebec into one of North America's most ideal geographic locations for test marketing (Mullman 2009).

ESTIMATION STRATEGY

As mentioned previously, because we do not have data from before the imposition of the ban, we compare households cross-sectionally by carefully defining the treatment and control groups. In the program-evaluation literature, 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 conditions in the following three dimensions to estimate the effect of the ban: (1) by language, (2) by province, and (3) by children.

First, because FP households primarily consume media from Quebec-based French-language media sources, whereas AP households tend to consume English-language media from outside the province, we would expect FP households to consume significantly less fast food than AP households in Quebec if the ban is effective. In terms of a generic regression model (to focus on the intuition in the exposition, we avoid household and province subscripts), we propose the following:

$$Y = f(Fr), \tag{1}$$

where Y is the dependent variable (this can be either the household's decision to purchase fast food or total fast-food expenditure conditioned on decision to purchase), and Fr is the dummy variable for FP households (Fr = 1 if FP households and 0 if AP households). Following the literature in program evaluation, the effect of the ban can be estimated as the first differenced estimator as follows: $\tau_{Fr} = \hat{Y}_{Fr} - \hat{Y}_{An}$, where $\hat{Y}_{Fr}$ and $\hat{Y}_{An}$ are the estimated average purchase incidence or fast-food expenditure of FP and AP households, respectively. Note that this is the underlying model that Goldberg (1990) uses to measure the effect of the ban. One problem with this approach is that if there are persistent intrinsic differences between AP and FP households that cause the differences in expenditures, this approach will bias the estimated effect of the ban. As we noted previously, one approach to overcome this problem would be to use data from both before and after the ban was imposed. Because we do not have pre-ban data, however, we use an alternative approach to control for these potentially intrinsic differences and classify consumers over another two dimensions: province and family composition.

Second, the ban applies to the province of Quebec but not to the neighboring province of Ontario. This implies that neither FP nor AP households in Ontario come under the purview of the ban. We expect that if the media-consumption habits of AP households in Quebec and Ontario are similar, there should not be a significant difference in expenditures between AP households in the two provinces. Similarly, FP households in Ontario are exposed mainly to media originating in Ontario, and therefore, their expenditures will be closer to those of AP households and different from those of FP households in Quebec. Using this approach to measure the effect, we respecify the generic regression model as follows:

$$Y = f(Fr, Q). \tag{2}$$

Here, Q is the dummy variable for Quebec (Q = 1 if Quebec and 0 if Ontario). In this case, the DD estimator can be expressed as $\tau_{Fr} = (\hat{Y}_{Fr,Q} - \hat{Y}_{An,Q}) - \hat{Y}_{Fr,ON} - \hat{Y}_{An,ON})$, where $(\hat{Y}_{Fr,Q} - \hat{Y}_{An,Q})$ and $(\hat{Y}_{Fr,ON} - \hat{Y}_{An,ON})$ are the estimated average differences between FP and AP households in purchase incidence or expenditure in Quebec and Ontario, respectively. One limitation of our data is that we can observe only household-level expenditure, not the expenditure specific to children. If we consider differences only in households with children, we would not be able to discern whether these differences were due to the different consumption levels of the children or to the different consumption levels of the adults in those households. Therefore, we add a third criterion, children, to classify the households in the sample.

Third, the nature of the ban implies that households with children will be affected more than households without children. Specifically, if the ban is effective, FP households with children in Quebec will be the most affected. Thus, to control for potential differences in the consumption of adults, we add a dummy variable for households with children (C = 1 for households with children and 0 for households without a child):

$$Y = f(Fr, Q, C). \tag{3}$$

In this case the triple difference-in-difference (DDD) estimator can be expressed as follows:

$$\begin{aligned}\tau_{Fr,Q,C} = &\left[\left(\hat{Y}_{Fr,Q,C} - \hat{Y}_{A,Q,C}\right) - \left(\hat{Y}_{Fr,ON,C} - \hat{Y}_{A,ON,C}\right)\right] \\ &- \left[\left(\hat{Y}_{Fr,Q,NC} - \hat{Y}_{A,Q,NC}\right) - \left(\hat{Y}_{Fr,ON,NC} - \hat{Y}_{A,ON,NC}\right)\right],\end{aligned} \tag{4}$$

where $(\hat{Y}_{Fr,Q,C} - \hat{Y}_{A,Q,C})$, $(\hat{Y}_{Fr,ON,C} - \hat{Y}_{A,ON,C})$ are the estimated average differences between FP and AP households with children in purchase incidence or expenditure in Quebec and Ontario, respectively; similarly, $(\hat{Y}_{Fr,Q,NC} - \hat{Y}_{A,Q,NC})$, $(\hat{Y}_{Fr,ON,NC} - \hat{Y}_{A,ON,NC})$ are the estimated average differences in case of households without children. So, in terms of experimental design, we ultimately create eight groups (two provinces × two languages × two types of households). As a result, if the ban is effective, we should find that the difference between FP and AP households with children in Quebec are both larger than the equivalent difference in households in Ontario and larger than the difference between FP and AP households without children.[7] Next, we provide descriptive statistics of the differences in expenditures among these eight groups.

Figure 1, Panel A, shows the eight household groups' fast-food expenditures per week. Note that across the groups, households in Quebec spend less than households in Ontario. We observe the largest difference between our key comparison groups—FP and AP households with children in Quebec. Specifically, FP households spend CDN$2.19 less per week than their AP counterparts. This result can be thought of as the first-differenced estimate. To control for unobserved cultural effects, we need to adjust this estimate to take into account the difference between similar language groups in Ontario. In Ontario, the difference between FP and AP households with children is –CDN$.75. Note that in this case, FP households with children are not under the purview of the ban, so this difference may be due to cultural or other inherent differences between FP and AP households with children. After adjusting for this difference, the DD estimate reduces to –CDN$1.44. Still, this difference cannot be attributed entirely to the advertising ban, because it may result from inherent differences in expenditures on the part

[7]Note that in the case of linear regression, the parameter associated with a three-way interaction term can capture this triple-differenced effect. If the function is linear, such that $Y = \alpha + \beta_{Fr}Fr + \beta_Q Q + \beta_C C + \beta_{Fr,Q}Fr \times Q + \beta_{Fr,C}Fr \times C + \beta_{Q,C}Q \times C + \beta_{Fr,Q,C}Fr \times Q \times C + \nu$, then $\tau_{Fr,Q,C} = \beta_{Fr,Q,C}$.

of adults in these households. Therefore, we first estimate similar DD estimates for the FP and AP households without children and then use this estimate to adjust the estimate for the households with children. The DD estimate for the households without children is CDN$.32. According to these simple weighted average expenditures, the DDD estimate will be –CDN$1.76.

Next, Figure 1, Panel B, shows the average fast-food expenditures after excluding households that do not purchase fast food during the period of the surveys. Note that in this case, the differences between comparison groups decrease except in the case of difference between FP and AP households with children in Quebec. The pattern of the differences in all other cases suggests that when households decide to purchase fast food, there are no large differences in the levels of expenditure. In the case of FP households with children in Quebec, this pattern suggests that it is possible that conditional on their decision to purchase fast food, they still spend less than AP households with children. Figure 2 plots the percentage of households that bought fast food at least once during the period of the surveys. Again, we observe a similar pattern: A smaller number of FP households than AP households purchased fast food, with the largest observable difference between FP and AP households with children in Quebec. According to these population-weighted averages, the simple average DDD implies that FP households with children in Quebec have an 8.59% lower propensity to purchase fast food in any given week. Note that the differences presented in Figures 1 and 2 do not control for key demographic and seasonal differences. Therefore, we add numerous demographic covariates to control for such differences in our regression analysis.

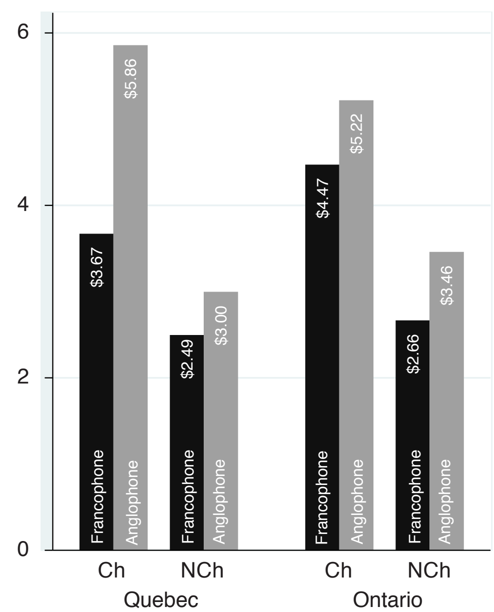
Next, to simplify the exposition, let Γ be the vector of dummies and interaction terms that define our treatment and control groups: $\Gamma = [Fr\ Q\ C\ Fr \times Q\ Fr \times C\ Q \times C\ Fr \times Q \times C]$. We can now express our dependent variable Y as

$$Y = f(\Gamma\beta + Z\delta), \quad (5)$$

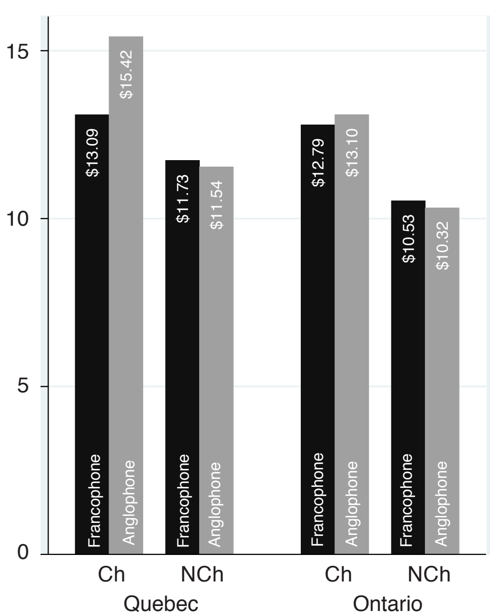
where β is the vector of parameters associated with Γ, Z is the vector of control variables, and vector δ is the associated parameters. As we mentioned previously, we estimate the effect of the ban at two stages, beginning with the level of decision to purchase. We model this first stage as a probit model where the dependent variable is the decision to purchase fast food within a week. Conditional on the decision to purchase, in the second stage, we model the amount spent per week on fast food. We estimate these two stages simul-

Figure 1
EXPENDITURE PER WEEK

A: Including All Households

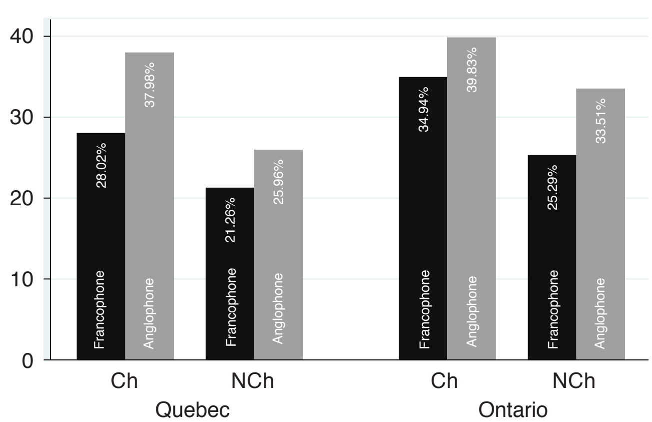


B: Households with Expenditure > 0



Notes: Ch = households with children, and NCh = households without children.

Figure 2
PERCENTAGE OF HOUSEHOLDS WITH POSITIVE FAST-FOOD EXPENDITURES (WITHIN THE TWO WEEKS OF SURVEY PERIOD)



Notes: Ch = households with children, and NCh = households without children.

taneously after taking into account any correlation in the errors of the two stages of the model. Note that our model is a variation of the model proposed by Heckman (1976, 1979). The Heckman model is actually a generalization of the widely used but more restrictive Tobit censored regression model (Amemiya 1985). The model in Equation 5 will be a Tobit model if we restrict the coefficients and regressors to be the same for both purchase and expenditure decisions. Furthermore, the Heckman model facilitates the use of different covariates in the two stages and provides consistent parameter estimates in the presence of heteroskedasticity (Amemiya 1985). To check for robustness, we also estimate the effects using OLS.

We use the following set of covariates (Z) to estimate the model. In terms of demographic variables, we include number of children in the household, household income, number of household members, occupational category for the head of household and his or her spouse (blue-collar or manufacturing occupation, pink-collar or service-sector occupation, and no occupation; we use white-collar or professional occupations as the excluded category), home ownership (1 if household owns the home, 0 otherwise), social assistance (1 if household receives social assistance, 0 otherwise), level of education of the male and female heads of the households (1 = "less than 9 years education," 2 = "some secondary education," 3 = "some postsecondary education," 4 = "postsecondary certificate or diploma," and 5 = "university degree"), dual-income households (1 if both female and male household heads are income earners and 0 if otherwise), immigration status of spouses (1 if immigrants and 0 if otherwise), and age of heads of the household. In addition to these demographic variables, we also use yearly dummy variables, with 1984 as the base year, and quarterly dummies, with the fourth quarter as the base, to control for year-specific and seasonal effects on the outcome measures.

In the case of two other covariates (i.e., price and cable television subscription), we use information from the existing databases to create two new variables. In terms of price, FoodEx data files only provide information on the amount spent and number of occasions per week by meal type (i.e., breakfast, lunch, and dinner). Thus, for the households with a purchase history during the period of the survey, we divide their total fast-food expenditure by the number of meals consumed in a week to calculate the price. For those households that did not purchase fast food, we use an imputed price. To impute the price of a fast-food meal, we first identify the households that purchased only one type of fast-food meal (i.e., breakfast, lunch, or dinner) during the week, which allows us to observe the specific price they paid for that type of meal. Using these households, we estimate the median price of the meal for the given meal type by region and by year. To estimate a weighted average price for a fast-food meal, we calculate the proportion of breakfasts, lunches, and dinners purchased in the region that year and use those proportions as weights. Using these weights multiplied by the median meal prices, we calculate the weighted average price of a fast-food meal for each province in each year. We use this as the imputed price for those households that do not report any fast-food consumption. As a robustness check, we also use the estimated average breakfast, lunch, or dinner price per trip by province, week, and year. Qualitatively, the results presented here are robust to the change in price measurement. Moreover, we note that when considering the recorded prices paid for fast food, we find no significant differences between our key treatment and control groups. For example, in 1992, the average fast-food meal cost a FP household in Quebec was CDN$4.64, while their AP neighbors spent an average of CDN$4.58. The median price is the same for both groups. To make prices across years comparable, we deflate all food prices using the Consumer Price Index for restaurant food to put prices in 1992 Canadian dollars.[8]

As we previously mentioned, one factor that can affect consumption is exposure to media, particularly television. 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 television subscriptions, but it does not contain explicit information on the amount of time spent in front of the television or the type of programming viewed. Another estimation challenge is that because the FoodEx and FamEx surveys are conducted on different samples, we cannot directly observe access to television by the households in the FoodEx databases. Instead, we project television ownership from FamEx to FoodEx data using the following approach: By year and by province, we estimate a probit model of access to cable television as a function of household characteristics and sampling weights using the FamEx data, and then using the same set of characteristics and sampling weights in the FoodEx files, we predict the probability (i.e. the propensity score) of cable television subscription. In 1992, our database indicated that 65% of Canadian households paid for cable television. By relying on cable subscription fees to proxy for television ownership, our proxy for television ownership will most likely be an underestimate.[9]

Note that the first stage of the Heckman model, which is a probit, is highly nonlinear in its parameters. As a result, the estimated three-way interaction parameter will not, in and of itself, capture the effect of the ban; rather, the effect of the ban is given by the differences in the probability of purchase between treated and control groups (i.e., the differences in the cumulative density function under treatment and control conditions). Similarly, given that we use the natural log of expenditure in the second stage of the Heckman model, we use a similar approach to estimate the second-stage DD effect on fast-food expenditures

MODEL ESTIMATES

We use the full-information maximum likelihood method to estimate the Heckman model. Note that the model can be identified under either exclusion restrictions or parametric assumptions (Wooldridge 2002). To check the robustness of our results, we try both. Qualitatively, we obtain similar results with and without exclusion restrictions. Because we do not have strong empirical or theoretical reasons to

[8]Further details on the methods to construct price variable are available on request.

[9]Our data also include whether a renter received cable free of charge. These households are included as having access to cable. Further details on the imputation of the cable television are available on request.

exclude variable(s) in either stage of the estimated model, here we present only the model without exclusion restrictions.[10] Because the log of nonzero expenditure data closely approximates a normal distribution, we use the natural log of expenditure in the second stage. We also use population probability weights and cluster errors by region and by year to correct for the sampling procedures used in the survey.[11]

Table 2 presents the parameter estimates using three regression techniques: OLS, Tobit, and Heckman. In the case of OLS, we estimate the decision to purchase (i.e., "Purchase Decision" in Table 2) and the expenditure (i.e., ln(Expenditure)) equation separately. For the Tobit model, we assume the parameters for the first and second stages to be the same, so the estimated results are presented as a single equation. For the Heckman model, we estimate the two stages simultaneously (i.e., the decision to purchase and the amount spent) but relax the Tobit assumption of equality of the parameter estimates in both stages.

In terms of the vector of treatment variables (Γ), for the first stage (i.e., selection), in the case of OLS and the Heckman approach, we find a negative and significant effect of the FP dummy and three-way interaction of FP, households with children, and Quebec dummies (i.e., $p < .05$ and .01, respectively). It is noteworthy that, in the case of OLS, the Quebec dummy is also negative and significant ($p < .01$), whereas in the Heckman model, the interaction between the households with children and the Quebec dummies is significantly different from 0 ($p < .1$). In the case of the expenditure equation, none of the dummies or interactions are significant under either the OLS or Heckman. Note that in the Heckman model, the second stage is conditioned on deci-

[10]Regression results based on exclusion restrictions are available on request.

[11]Our data set contains 14,867 observations, which, when weighted, represent almost 20 million households. This large sample size helps avoid problems related to multicollinearity in a model with a comprehensive set of covariates. None of the estimated standard errors are unusually large enough to become a cause for concern. For helpful discussions on sample size and multicollinearity, refer to Goldberger (1991), Hansen (2010), and Wooldridge (2009).

Table 2

OLS, TOBIT, AND HECKMAN REGRESSION RESULTS (SAMPLE SIZE: 14,867)

Estimation Method:	*OLS*		*Tobit*	*Heckman*	
	Purchase Decision	*ln(Exp)*	*ln(Exp)*	*Purchase Decision*	*ln(Exp)*
Dummy: children	–.005	–.012	–.088	–.032	–.004
Dummy: FP	–.088***	.05	–.63***	–.265***	.082
Dummy: Québec	–.1***	.035	–.635***	–.064	.062
Dummy: children × FP	.052	–.068	.394	.178	–.092
Dummy: children × Quebec	.049	.002	.342	.188*	–.013
Dummy: FP × Quebec	.03	–.094	.093	.077	–.098
Dummy: children × FP × Quebec	–.111**	–.045	–.755**	–.358***	–.011
Number of children	–.011	.089***	–.058	–.063***	.091***
Probability of cable television access	.061*	.351***	.861***	.468***	.319***
Fast-food price	.139***	.374***	1.081***	–8.608***	.336***
Fast-food price^2	–.003***	–.009***	–.025***	1.039***	–.008***
Household income	1.852***	1.171	14.4***	5.157***	.649
Household income^2	–5.217*	3.487	–39.165**	–12.512	4.964
Number of household members	.005**	.03***	.059***	.016**	.028***
Dummy: male blue-collar occupation	–.035**	.112**	–.18	–.091**	.123***
Dummy: male pink-collar occupation	–.039***	.056	–.255***	–.139***	.068*
Dummy: no male occupation	–.012	.009	–.086	–.067*	.011
Dummy: female blue-collar occupation	–.109***	.083	–.864***	–.362***	.128
Dummy: female pink-collar occupation	.028**	.038	.217***	.075**	.029
Dummy: no female occupation	–.02**	.043	–.14*	–.067**	.05
Dummy: home ownership	.011	–.052	.083	.018	–.057*
Dummy: recipient of social assistance	–.072***	–.09	–.71***	–.233***	–.062
Male education	.014***	.03***	.124***	.05***	.024***
Female education	.005	–.033***	.021	.017*	–.035***
Age of household head	–.004***	–.003	–.038***	–.014***	–.002
Dummy: dual-income household	.004	.03	.001	–.01	.029
Dummy: both spouses immigrants	–.058***	–.043	–.427***	–.166***	–.022
Dummy: 1986	–.012	.066*	.028	.442***	–.03*
Dummy: 1990	–.047**	.062	–.172	.509***	.031
Dummy: 1992	–.045***	.161***	–.135	.497***	.05**
Dummy: first quarter	.037***	–.018	.265***	.126***	.061*
Dummy: second quarter	.036***	.045	.283***	.118***	.064
Dummy: third quarter	.045***	.066*	.387***	.151***	.162***
Intercept	–.084	.447	–4.614***	16.687***	.752***
Model fit measure	.087	.13	.047	.106	
	Simple R^2	Simple R^2	Psuedo R^2	Psuedo R^2	

*Significant at 10% level.

**Significant at 5% level.

***Significant at 1% level.

Notes: We define white collar as managerial, professional, or teaching; blue collar as farming, fishing, forestry, mining, processing, manufacturing, or construction; and pink collar as clerical, sales, or service. We define the education variable as follows: 1 = less than nine years, 2 = some secondary, 3 = some postsecondary, 4 = postsecondary certificate, and 5 = university degree. Those with missing education were dropped.

sion to purchase, implying that when the decision to purchase is taken into account, none of the treatment dummies and their interactions have a significant effect on expenditures. In contrast, for OLS, we estimate the expenditure equation only for the consumers who purchased fast food. Compared with the OLS and Heckman results, in the case of Tobit model, we find FP, Quebec, and the three-way interaction dummies to be negative and significant ($p < .01$, .01, and .05, respectively).

As further evidence that media exposure matters, we find that access to cable television significantly affects the outcomes in all three models (for the Heckman model, $p < .01$). Although we cannot decisively link television viewing to greater consumption of fast food, this result does indicate that households with access to cable television also purchased more fast food, even after we control for income and other demographic characteristics.

Next, we explore which estimation model is more appropriate. For the first stage of the estimation, given that it models a discrete choice, a probit is more appropriate than OLS. We also find that the error terms in the first- and second-stage regressions are not independent. Specifically, the correlation between the error terms is significantly different from 0 ($p < .01$), implying that we need to take the correlation among the error terms into account when estimating the two stages. After ruling out the appropriateness of using OLS, we check for the validity of the parametric restrictions in the Tobit model. Note that in the Heckman model, some of the parameter estimates on the same characteristics hold different signs in the first- and second-stage estimates, where both estimates are significantly different from 0. For example, the number of children significantly decreases the probability of purchasing fast food but significantly increases the amount spent. Other examples of alternating effects are the coefficient of the dummy variable for blue-collar male occupation, female education, and fast-food price and price squared. The strikingly different coefficient estimates between these two estimated equations lead us to believe that the Heckman model is the appropriate approach rather than the more restrictive Tobit, which assumes that these coefficients are the same (Greene 2003). Finally, note that in the Heckman model, fast-food price has a quadratic effect on consumption. In the second stage, the positive sign on the linear portion of the price effect indicates a possibility of price endogeneity; however, the effect of pricing across conditions should cancel out in DDD estimates, and therefore, we do not believe that this potential endogeneity biases our estimated effect of the ban.

Our argument on the negligible effect of probable price endogeneity in DDD estimates suggests that we should not observe significant changes if we drop price measures from the model. Indeed, this is the case; significance level and directions of the estimated parameters do not change, although we do observe small changes in estimated effects (e.g., the DDD estimate in the first stage changed from 13% to 11% with no change in the p-value). Also note that if we had dropped the price variables from the model, we would have created the potential for other biased parameter estimates. We decided, therefore, to present results based on a model with price variables. As a robustness check, we also estimated a model with breakfast-, lunch-, and dinner-specific pricing. The DDD estimate is 12.75% with no change in p-value.

As we noted previously, because all reported estimates come from nonlinear models, we must calculate the differences in probabilities and expenditures for the treatment and control groups. We present the marginal effect of the ban for the OLS, Tobit, and Heckman models in Table 3. In the Tobit model, the parameters for the first and second stage are forced to be the same. Therefore, we present the result only for the second stage. For the OLS and Heckman models, we present estimates for both stages.

Using the Heckman model, we find significant differences in the propensity to consume fast food: FP households have a 13.4% ($p < .01$) lower propensity to consume fast food than AP households (Row 1). Note that this comparison is similar to that used by Goldberg (1990), which indicates that our results echo his findings in terms of fast-food consumption. However, we observe no significant difference between FP and AP households in Ontario (Row 2). By subtracting Row 2 from Row 1, we get the first DD estima-

Table 3

DIFFERENCE ESTIMATES ON FAST FOOD PURCHASE DECISIONS AND EXPENDITURES

Comparison	*OLS*	*Tobit*	*Heckman*
Decision to Consume Fast Food (First Stage)			
[1] Difference between FP and AP households with children in Quebec	–.117***		–.134***
[2] Difference between FP and AP households with children in Ontario	–.036		–.032
[3] DD: [1] – [2]	–.081*		–.102**
[4] Difference between FP and AP households without children in Quebec	–.057**		–.067*
[5] Difference between FP and AP households without children in Ontario	–.087**		–.095*
[6] DD: [3] – [4]	.03		.028
[7] DDD: [3] – [6]	–.111***		–.13**
Amount Spent (Second Stage) [$/Week]			
[8] Difference between FP and AP households with children in Quebec	–1.28**	–.18***	–1.31
[9] Difference between FP and AP households with children in Ontario	–.15	–.08	–.11
[10] DD: [8] – [9]	–1.14	–.09	–1.2
[11] Difference between FP and AP households without children in Quebec	–.38	–.1*	–.19
[12] Difference between FP and AP households without children in Ontario	.44	–.2*	.96
[13] DD: [11] – [12]	–.83	.11*	–1.15
[14] DDD: [10] – [13]	–.31	–.2*	–.05

*Significant at 10% level.
**Significant at 5% level.
***Significant at 1% level.

tor, which controls for any intrinsic differences between FP and AP households with children in Quebec. In this case, the DD estimate (Row 3) implies that the ban led to a decrease in purchase propensity by 10.2% ($p < .05$). Next, we compare households without children. In this case, we find marginally significant ($p < .1$) differences in the propensity to consume fast food between FP and AP households both in Quebec and in Ontario. However, the estimated DD (Row 6 = Row 4 – Row 5) is insignificant in this case. Row 7 provides the DDD estimates. Here, we find that FP households with children in Quebec have a significantly lower probability (13% with $p < .05$) than AP households of consuming fast food in a given week after taking into account the differences in the rest of the control groups. Note that this difference is close to the difference estimated between FP and AP households in Quebec (Row 1). In terms of the second-stage decision on how much to spend, we do not find any of the difference estimates to be significant. This finding implies that after households make the decision to consume fast food, there are no significant differences in the amount spent on fast food across our comparison groups. This result may be driven by the fact that most fast-food restaurants are nationwide chains whose menus tend not to show large product or price variations; as a result, when consumers decide to purchase fast food, the amount spent does not vary significantly.

Note that for the first stage, the OLS and Heckman models provide similar patterns in estimated effects; more importantly, the crucial DDD estimates are close (11% and 13%, respectively) and significantly different from 0 at the 5% level. For the second stage, OLS and Heckman results are similar except in the case of the difference between FP and AP households with children in Quebec. We find marginally significant DDD estimates with the Tobit models ($p < .1$) but no significant effect in the case of the OLS and Heckman models. Nonetheless, note that in all three cases, the effect is negative. In terms of the DD estimates in the second stage, we find no significant differences in the case of households with children in all three models (Row 10). However, in the case of households without children, Tobit results provide evidence of marginally significant difference (Row 13). Under all three models in the second stage, the crucial DDD estimates imply a negative effect of the ban on fast food consumption for FP households with children in Quebec. In terms of significance, the Tobit and first-stage OLS and Heckman show similar patterns. However, the Heckman approach helps us decompose the effect into the two stages of the decision process after relaxing restrictive assumptions of Tobit and enables us to observe precise estimates of both the decision to purchase and the amount spent.

As a further robustness test, we use the matching estimator developed by Abadie and Imbens (2006) to match households across Quebec and Ontario by language and the other characteristics used in the Heckman regression. Whereas the DDD approach gives us more information about the characteristics associated with fast-food expenditures and allows us to disentangle the propensity to purchase from the amount spent, the matching estimators only inform us about the effect of treatment—in our case, the effect of the ban. However, because the matching estimator does not rely on specific assumptions about functional form, it serves as a good robustness check for our previous results. Using this nonparametric approach, we obtain very similar results, indicating that the ban has a significant effect, primarily on the propensity to consume fast food.[12]

To check whether we are simply observing an overall effect of total food expenditures, we run a similar regression for total household food expenditures. The DDD estimate in this case is not significantly different from zero, which indicates that the effect we estimate is not an artifact of differences in overall food expenditure patterns.[13]

Persistence

One of the particular concerns about advertising targeting children is that it may not only influence concurrent consumption but also shape future consumption behavior. Therefore, we consider whether the ban affects purchasing patterns as children in Quebec age and are exposed to advertisements. Here, we encounter a further set of data constraints. First, because data on mother tongue are not collected after 1992, we can consider only those households that were affected by the ban when it was first imposed. Second, because we do not have specific data on the age of children in the household, we cannot consider households with teenagers older than 15 years separately from households with multiple adults. Therefore, we examine fast-food expenditures of households composed of people under 25 years of age in 1992 (i.e., consumers targeted by the ban when it was first imposed) and compare them with households composed of people 35 years of age and above (i.e., consumers not targeted by the ban in 1980). Third, we have the specific ages only for the people who answer the questionnaire and their spouses; therefore, we limit ourselves here to households of one or two members, in which the young-adult respondent is less likely to be responding for his or her aging parents or extended family. Because the overall results using the Heckman approach suggest that the ban primarily decreases FP households' propensity to purchase fast food, we focus on the persistence of the ban's effect on the decision to purchase fast food for FP households under the age of 25 years (i.e., young adults). Fourth, we do not have specific information on where households previously lived, so our analysis implicitly assumes that the majority of the young population remains in the same province. We compare the probability of purchase between young FP and AP households living in Quebec and Ontario with their older counterparts.

Our results (Table 4) suggest that young FP adults are more likely to purchase fast food if they live in Ontario than if they live in Quebec, whereas the reverse is true for young AP adults. In our data set, an FP young adult is 38% less likely to purchase fast food in a given week if he or she lived in Quebec than if he or she lived in Ontario, whereas a similar AP young adult is 24% more likely to purchase fast food if he or she lived in Quebec. The resulting DD is 63% and is significantly different from 0 at the 5%level. Comparing the younger adults to their older counterparts, we

[12]The results based on the matching estimation techniques of Abadie and Imbens (2006) are available on request.

[13]One difference in the specifications is that because all households spend money on some form of food, we do not control for selection. Detailed regression results are available on request.

Table 4

PROBIT ON FAST-FOOD PURCHASE DECISION OF HOUSEHOLDS UNDER 26 YEARS AND THOSE 35 AND OVER IN 1992

	Under 26 Years	35 Years and Over
[1] FP in Quebec vs. Ontario	–.387	–.165*
[2] AP in Quebec vs. Ontario	.244	–.076
[3] DD: [1] – [2]	–.631**	–.088
[4] DDD: [3] Under 26 – [3] Over 35	–.542	

*Significant at 1% level.
**Significant at 5% level.

find that both groups of older adults are more likely to purchase fast food if they live in Ontario than in if they lived in Quebec and that this difference is smaller than that for the young adults. Therefore, we see a large DDD effect, which, though not significantly different from zero, does provide an indication that the ban on advertising targeting children may continue to affect purchasing behavior as those children become adults.

Estimated Effects

Given that the ban has a statistically significant effect on fast-food consumption at the household level, we estimate the economic effect of the ban. In this case, we use the significant DDD estimates from the first stage of the Heckman model and information from the existing literature on obesity and nutrition to infer the impact of the ban. As noted in Table 3, we estimate that the ban reduces the probability of fast food purchase incidence by 13% per week. According to the number of FP households with children in Quebec cities in 1992 (i.e., 310,617 households) this reduction suggests that 40,691 fewer households purchased fast food in any given week. We can extrapolate to lost annual sales, noting that FP households purchasing fast food spent an average of CDN$13.09 per week, which suggests lost revenue from the Quebec urban market of CDN$27.6 million in 1992 dollars. If we assume that the effect is similar for households in small cities and rural areas, the estimate will be CDN$65.4 million. This amount is equivalent to US$88 million in 2010.

What do these results mean in terms of calories consumed? These amounts translate into 7.1 million fewer meals sold in the urban areas and, if we extrapolate to all FP households in Quebec, 16.8 million fewer meals sold overall. With 800–1100 calories per fast-food meal,[14] that means that urban households in Quebec consume between 5.6 billion and 7.8 billion fewer fast-food calories per year as a result of the ban. Similarly, if we extrapolate to all FP households with children in Quebec, the estimate will be between 13.4 billion and 18.4 billion fewer fast-food calories. We cannot explicitly estimate the net calories, because these consumers presumably ate something else when they decided not to purchase fast food. That said, in two separate studies, consumers eating a fast-food meal added an extra 200 calories for that meal (Bowman and Vinyard 2004; Paeratakul et al. 2003). Recognizing that these studies were done on U.S. adults, if we assume that Quebec consumption patterns are otherwise similar to those in the United States, the ban would have reduced net calorie consumption 1.4 billion calories per year in urban areas, or 3.4 billion calories for the entire province of Quebec. Pereira et al. (2005) estimate, after controlling for all other probable factors, that frequent fast-food consumption can lead to 4.5 kg (or 9.9 lb) of weight gain over 15 years. Assuming that the increase in probability of purchase moves a household to being a "frequent fast-food consumer," by 1995, the ban may have resulted in a .6 kg (1.3 lb) lower body weight of Quebec FP household members. Perhaps more important, lower fast-food consumption is also associated with lower rates of disease. Over the same time period, Pereira et al. (2005) find that frequent fast-food consumption was associated with a twofold increase in insulin resistance, a key precursor of type 2 diabetes.

SUMMARY AND CONCLUDING REMARKS

Advertising targeting children has become a major cause for concern for policy makers in a number of countries, primarily because of the belief that advertising has increased fast food consumption and is thus related to the exponential increase in obesity among children. Several countries are responding by considering banning the advertisement of unhealthy food to children. One jurisdiction that has a ban on all child-specific advertising is the Canadian province of Quebec. In this article, we report our analysis of the effect of this ban on fast food expenditures by households in Quebec.

We identify the effect of the ban by noting that given the nature of Quebec's media market and demographic composition, the ban will disproportionately affect French-speaking (rather than English-speaking) households in Quebec and will not affect similar households in Ontario or households without children in either province. We find that during our study period, French-speaking households with children are significantly less likely to purchase fast food if they live in Quebec than if they live in Ontario. To address the concern that inherent cultural differences may affect preferences for fast food and thus may be responsible for the difference between FP and AP consumption, we use a DDD estimator, comparing between French- and English-speaking households without children, and find a much smaller, and insignificant, difference in terms of both the likelihood of purchasing fast food and the amount spent. Thus, the result that we observe affects only French-speaking households with children in Quebec—not their English-speaking neighbors, their French-speaking counterparts in Ontario, or their French-speaking neighbors without children. Our estimated Heckman model implies that the ban significantly decreased propensity to consume fast food by 13% for the effected households. This estimate is robust to alternative estimation methods. Furthermore, we believe that, if anything, our findings underestimate the effect of the ban. For example, if French-speaking adults are affected by the reduction in fast-food advertisements during shows targeted at both adults and children, our results will be biased downward. In short, we believe that the current analysis provides evidence that the advertising ban affects consumption. Finally, we find tentative evidence that the effect of the ban persists as the affected children become young adults.

[14]These numbers are based on calorie calculations for regular extra value meals from McDonald's (http://nutrition.mcdonalds.com/nutritionexchange/nutritionfacts.pdf).

In terms of policy implications, the current study provides evidence that a ban on advertising targeting children can be effective in lowering or moderating consumption, and estimates of the effect in expenditures suggest that the social-welfare impact of such a ban can be significant. It is pertinent to ask, given this finding, whether other jurisdictions in Canada or other countries should implement similar bans. To this end, our results warrant caution. We find that it is primarily French-speaking children who are affected by the Quebec ban, while English-speaking children—who have greater access to media from the neighboring U.S. states and Canadian provinces—are less affected. This finding indicates that media spillover can blunt the effect of an advertising ban, which suggests that a ban imposed by a single state or province may not be effective if there is substantial media overlap and that advertising regulations are likely to be more effective if several jurisdictions can coordinate their efforts. Moreover, given the rapid changes in information technology that have led to children spending more and more time on video games and computers, any attempt to impose a similar ban will be challenging. Notably, consumer advocates in Quebec are currently using the ban to pursue Internet advertising. (Specifically, the Coalition Québécoise sur la Problematique do Poids successfully challenged Lucky Charms cereal for advertising Internet games on their food packaging.) It remains to be seen whether the effective scope of the existing ban can be expanded to address the challenges posed by these new media.

Although at the time of its implementation the law did not have strong support from majority of consumers in Quebec (Caron 1994), a survey of Quebec residents in 2007 indicated that 60% wanted the province's advertising ban to be applied more strictly. Thus, it seems that Quebec consumers consider this regulation beneficial. Note that it is difficult to assess the effect of the ban on health outcomes without further knowledge of the detailed food and lifestyle habits (e.g., frequency and type of physical activity). However, significantly, Quebec has one of the lowest childhood obesity rates in Canada, though its children have one of the most sedentary lifestyles (Statistics Canada 2005). More important, the 2004 Canadian Community Health Survey shows that the combined overweight/obesity rate among 2- to 17-year-olds in Quebec is significantly below the national level.[15]

In terms of regulations of advertising targeting children, an alternative to an outright ban is voluntary industry-led regulations, as is currently in practice in the United States on a limited scale.[16] The effectiveness of such voluntary regulations needs to be studied. It is usually argued that as a result of battles for brand market shares, some products targeting children are advertised excessively. A case in point is the carbonated soft drinks category, in which advertisers spent nearly $20 per American teenager on targeted advertising in 2006.[17] If these dollars were largely spent in battles over market share, any regulation, whether voluntary or publicly mandated, could turn out to be welfare improving for a society.

To the best of our knowledge, the current study is the first application of the DD approach to estimate advertising effectiveness in a natural experiment. Given the messiness and incompleteness of field-level data, we believe that a similar approach can be used to determine the effectiveness of advertising in other similar contexts. For our data set, we use household consumption data available from Statistics Canada; similar publicly available data exist in the United States and many other developed countries. One advantage of using these data is that they tend to be rich in information on demographic characteristics and to have wider coverage across geographic regions. In addition, by using the sampling weights in such databases, it is possible to generalize the outcomes at the population level with greater confidence.

A limitation of the current study is that we examine only the effect the advertising ban on expenditures on a single food category. Finally, because of data limitations, we were not able to build and estimate models linking fast-food purchase decisions, expenditures, and health outcomes. In addition, long-term impacts of such bans need to be explored. In the future, we plan to extend and explore these links further.

[15]The Canadian Community Health Survey collected information from more than 35,000 respondents between January and December 2004 and directly measured most respondents' height and weight rather than relying on self-reports, giving the most accurate picture of rates in 25 years. Regrettably, the survey did not collect data on mother tongue, so we cannot replicate our analysis using these data (see www.statcan.ca/Daily/English/050706/d050706a.htm).

[16]For further details, refer to http://www.bbb.org/us/children-food-beverage-advertising-initiative.

[17]See http://www.ftc.gov/speeches/leibowitz/080729foodmarketingtochildren.pdf.

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