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An Experimental Investigation of the Impact of Fat Taxes: Prices Effects, Food Stigma, and Information Effects on Economics Instruments to Improve Dietary Health

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PROJECT REPORT

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There is currently no published research on how food taxes may affect consumer behaviour when the imposition of the tax itself may be considered a source of consumer information. The work undertaken here seeks to address this gap in the literature by using experimental methods to enhance understanding on the joint effects of price changes induced by a fat tax and the stigma associated with the application of the tax. First, we conduct an interdisciplinary literature review (drawing from economics, psychology, and health promotion) and theoretical investigation of the impact of stigma on economic choice behaviours. We then employ Attribute-Based Stated Choice Methods (ABSCM) to elicit consumer response to fat tax scenarios that rely only on price changes, and to those that involve both price changes and stigma effects. The study is still ongoing, and will use a computer-assisted field data collection approach to collect data from participants at grocery stores and/or other food purchase venues. Econometric analysis of the resulting data will allow us to investigate the price response, stigma effect, and price-stigma interaction elicited by various taxation and labelling schemes. Preliminary results from pre-test samples are discussed here.

JEL Codes: I18, Q18

Key words: obesity; health policy; fat taxes; warning labels; choice experiments

Introduction

There is currently no published research that we are aware of on how food taxes may affect consumer behaviour when the imposition of the tax itself may be considered a source of consumer information. This research addresses this gap in the literature by using choice experiments to enhance understanding on the joint effects of price changes induced by a fat tax and the stigma associated with the application of the tax. Previous studies rely on estimates of food price response based on cross-sectional observation (Cash et al., 2005; Kuchler et al., Schroeter et al., 2007). This does not allow investigation of how consumers would respond to a fat tax that is labeled as such – that is, where the imposition of the tax itself is a signal to consumers regarding the quality of the product. The role of stigma in influencing consumer choice is something that is not well developed in the economic literature, but is clearly relevant to a variety of policy situations.

The current study is therefore a starting point for a novel collaborative research direction in stigma, policy interventions, and public health. This study is set up to allow us to test hypotheses such as: (1) fat taxes will have greater behavioural impact when accompanied with a stigmatizing label; (2) both the relationship of stigma to price effects and the overall effectiveness of economic incentives will vary across demographic groups; (3) economic incentives can affect health and wellness measures through dietary changes; (4) the impact of economic incentives will vary across demographic groups; and, (5) fat taxes may prove to be regressive, in that they will impose higher costs on lower-income consumers.

As stated in the initial proposal, CMD support was used to supplement the first

year of a two-year research program. The project is ongoing through the end of the calendar year 2008, with support from the Social Sciences and Humanities Research Council of Canada. This report therefore only outlines the literature review and preliminary methodological approach and pre-test results. Additional results will be provided to CMD upon completion of the research.

Review of the Literature

Information and economic incentives

The main issue this study focuses on is whether information labels and economic incentives can be an effective way to influence people to eat healthier. Some recent studies suggest that fat taxes may be effective in reducing unhealthy food consumption. Schroeter, Lusk, and Tyner (2007) created a microeconomic model to estimate the effects of a tax on high-calorie food. They conducted empirical analysis by obtaining statistics for price and income elasticities and using energy accounting to come up with weight elasticities. One of their findings was that a tax on high calorie soft drinks would cause a decrease in weight through decreased soft drink consumption. Other researchers who have focused their studies on soft drinks have similarly found that a tax on soft drinks may effectively decrease their consumption (Gustavsen, 2005; Tefft, 2006). Tefft (2006) used a reduced form linear approximation to estimate the effect of a tax on soft drinks. He found that a tax on soft drinks may result in decreased snack food consumption and increased revenue due to increased expenditure. It is important to note that he measures expenditures rather than quantities.

Other researchers are not as hopeful. Kuchler, Tegene, and Harris (2004)

simulated health outcomes of a fat tax by using reduction in weight as a measure of health. They calculated the effects of a tax on different levels of consumer responsiveness to price. For each elasticity scenario, four possible tax rates ranging from 0.4 to 30 percent were considered. They were able to calculate reduction in caloric intake for each scenario, assuming that nothing was substituted for the salty snacks and that all food purchases are consumed. From this they calculated reduction in body weight (3500 kcal per pound of body weight). Their results show that a small tax of 0.4 or 1 percent would not significantly affect consumption or health outcomes. In later work, the same authors further estimated demand functions for potato chips, all chips and other salty snacks. Using the resulting elasticity estimates, they explored the effects of a 1, 10 and 20 percent tax on each snack category. They found that a small tax on salty snacks would not impact diet very much and even a relative large tax would not appreciably affect the diet quality of the average consumer (Kuchler, Tegene, and Harris, 2005).

Smed, Jensen, and Denver (2005) combined econometric models of food consumption behavior in socio-demographic groups with models for conversion between food consumption and nutrient intake. They conducted simulations of four different scenarios: a tax on all fats, a tax on saturated fats, a tax on added sugar, and a subsidy on fibers. These are taxes on nutrients rather than types of food. They found that a tax on fats would decrease fat intake but increase sugar intake while a tax on sugar would decrease sugar intake but increase fat intake. Although these tax scenarios predict a decrease in energy intake, the authors conclude that tax or subsidy alone could not solve the obesity problem. They suggest combining a tax with other regulations, such as information campaigns, since there might be an interactive effect.

Boizot-Szantaï and Etilé (2005) used data from a French food expenditure survey to model the effects of different food group prices, income, and demographics on BMI. Their results suggest that the effectiveness of a fat tax may be limited in the short-run. The state of Maine had a snack tax between 1991 and 2001. Oaks (2005) used this as a natural experiment to evaluate the effect of a snack tax on obesity outcomes. The design of his project is an interrupted time series comparison group. His analysis revealed no relationship. He argued that although his study fails to support the hypothesis that a snack tax reduces obesity rates, the revenues observed from the snack tax could have been used to support other programs that may be more effective at reducing obesity.

In the public health and dietetics literatures, Simone French and colleagues have reported several experimental studies involving environmental interventions (French et al., 1997a; French et al., 1997b; French et al., 2001; Jeffery et al., 1994). French et al. (1997a) set up environmental interventions to determine the effects of pricing strategy on fruit and vegetable purchases in school cafeterias. They made fruit, carrots and salad in each school cafeteria about 50 percent cheaper during the intervention period and advertised these new prices. During the intervention period fruit sales increased by about four fold and carrot sales approximately doubled. Salad sales were not significantly different. With the increased sales from lower prices, sales revenue was not significantly reduced. This study suggests that decreasing the price of fruits and vegetables with minimal promotion may be an effective way to increase sales of these items to high school students (French et al., 1997a). Jeffery et al. (1994) conducted a similar experiment in the cafeteria of a university office building. In addition to reducing the prices of fruits and vegetables they increased the selection. The results suggest that

increasing selection and decreasing the price of fruits and vegetables may be an effective way to increase the amount of fruits and vegetables adults purchase (Jeffery et al., 1994).

French et al. (2001) used an experimental design to determine the effects of decreasing the price of low-fat snacks relative to regular snacks in vending machines. Four levels of pricing were examined. They found that a 10 percent decrease in price of low-fat snacks increased the percentage of snacks sold that were low fat without increasing sales volume, which suggests that customers may have been substituting low-fat snacks for regular snacks. This is a positive result from a public health perspective. Decreasing the price of low-fat snacks by 25 or 50 percent caused an increase in sales volume, which suggests that consumers may be buying more snacks from the vending machine, which could imply a negative net health outcome. Another possibility is that more consumers were attracted by the price decrease to those particular vending machines used in the study. It is difficult to evaluate the overall efficacy of these interventions because it is not known how the consumers ate throughout the day. An interesting finding of the last study is that lower prices on low-fat snacks were not associated with smaller profits, suggesting that this may be an inexpensive intervention (French et al., 2001). Environmental interventions in a restaurant setting have yielded similar positive results (Horgen and Brownell, 2002).

Stigma

This study analyzes the stigma related to buying a product with a warning label on it. Stigma, as defined by Fischoff (2001), is "demonstrated by *principled refusal to engage in an act that would otherwise be acceptable*" (cited by Flynn, Slovic &

Kunreuther, 2001, p. 361). Walker (2001) discusses the definition of stigma in depth, noting that a "stigma reaction is by definition out of line with what is warranted, which we determine on the basis of the best available science" (Flynn, Slovic & Kunreuther, 2001, p. 355).

The stigma associated with government programs to aid low-income families has been studied (Stuber and Kronebusch, 2004; Levinson and Rahardja, 2004). Stuber and Kronebusch (2004) attempt to explain the low participation rates in Temporary Assistance to Needy Families (TANF) and adult Medicaid programs. They interviewed patients at community health centers in the United States with incomes below 300 percent of the federal poverty level and at least one child in the household. Scales were created in order to measure stigma, enrollment barriers, and knowledge. The questions were asked in an indirect way in order to get more reliable responses. They find that there are two types of stigma: identity stigma, which is the concern about "being labeled by welfare stereotypes," and treatment stigma, which is concern about "poor treatment during the application process" (Stuber and Kronebusch, 2004, p. 526). They measured these two types of stigma separately using a questionnaire. They found that treatment stigma, perceived enrolment barriers, and lack of knowledge were the main reasons for low enrollment (Stuber and Kronebusch, 2004).

Levinson and Rahardja (2004) use the National Survey of America's Families (NSAF) to determine if the low enrollment in Medicaid could be a result of welfare stigma. This survey contains eight questions related to welfare stigma. They found that those who were not enrolled in Medicaid answered the questions in such a way that displays welfare stigma. This analysis suggests that welfare stigma and enrollment in

Medicaid are related, but it is not enough to show causality. In the second section of their analysis, Levinson and Rahardja (2004) use a utility-maximizing framework. They predict a Moffitt (1983) utility function with fixed and variable stigma for Medicaid and Food Stamps. According to this model, if there is a fixed stigma, participation rate will increase with benefit. If there is no fixed stigma, participation will not depend on the benefit. They find that increases in benefits of the programs substantially increases participation. This means that there is a fixed cost, which might be fixed stigma. This paper demonstrated two different approaches to examining stigma and participation: surveys to evaluate perceptions of programs and using a utility-maximizing framework (Levinson and Rahardja, 2004). Currie and Grogger (2000) use a third approach. They indirectly measure the presence of stigma using proxy variables (cited in Stuber and Kronebusch, 2004).

The stigma related to the discovery of hazardous waste and its cleanup has also been studied (Messer, Schulze, Hackett et al., 2006; Patunru, Braden & Chattopadhyay, 2007; McCluskey and Rausser, 2003). Messer, Schulze, Hackett et al. (2006) analyze the benefits of the hazardous waste cleanup known as Superfund. They look at the effect that delayed clean-up had on property values in communities neighboring Superfund sites. They develop a model that predicts the movement in time of the ratio of the property values of homes close to the Superfund site compared to homes far enough away to avoid being negatively affected. Their psychological/economic model shows that discovery, beginning of clean up, and any event related to the hazardous waste increases the fraction of homeowners and potential buyers who shun the neighboring communities. They used their predicted coefficients to run a simulation with four different scenarios with varying

number of events (announcement, clean up, delivery, etc.) as well as varying the amount of years it takes to clean up. Their results suggest that quicker cleanup and fewer stigmatizing events would reduce the loss of property value due to people shunning neighboring communities.

Patunru, Braden and Chattopadhyay (2007) use a latent segmentation model to estimate the benefits of the clean-up of hazardous waste in Waukegan Harbor, Illinois. It was declared a Superfund site. They conducted a choice experiment where residents of Waukegan Harbor were asked to think back in time to their last house purchase and to choose between their current house and hypothetical houses differing in certain attributes, including pollution of the harbor. They also asked if they thought the harbor was environmentally safe at the time of purchase. They use this information in their latent segmentation model to estimate Waukegan residents' willingness to pay for clean-up (Patunru, Braden & Chattopadhyay, 2007).

McCluskey and Rausser (2003) used a standard multiple-equilibrium Hedonic model to analyze the economic consequences of stigmatization from a hazardous waste site. They used a data set of 205 397 observations of homes sold from 1979 to 1995 in Dallas County, Texas. They used a Geographical Information Systems (GIS) database so the distance between each house and the hazardous waste site, airport, and mall could be calculated. They found that if there is a recovery and the waste is cleaned up, there is just a temporary drop in property values (temporary stigma). They found that there is long-term stigma only within a ~1.2-mile radius around the source of the hazardous waste (McCluskey and Rausser, 2003).

The stigma surround fish consumption advisories when dealing with

contaminants, such as mercury in fish have also been studied (Shimshack, Ward & Beatty, 2007; Jakus and Shaw, 2003). Shimshack, Ward, and Beatty (2007) use parametric and nonparametric methods to examine the consumer response to an advisory by the Food and Drug Administration (FDA) in the United States that recommended at-risk individuals to limit fish consumption due to contamination with mercury. The educated and well-read at-risk individuals reduced their intake of fish; however, some consumers that were not considered at-risk also reduced their consumption (Simshack, Ward, & Beatty, 2007). This could indicate a stigma behind these fish consumption advisories. Jakus and Shaw (2003) estimated a model for consumers' endogenous risk perceptions about products and applied it to recreational fishing. They found that the perception of hazards associated with fish consumption advisories affect recreational site choice as well as welfare (Jakus and Shaw, 2003).

Choice experiments and food purchasing behaviour

Choice experiments present the participant with a set of choices and asks them to choose an option. Choice experiments can be very useful because it is possible to incorporate products that do not exist. Also, attribute levels (e.g. price) can be varied to levels that are not observable on the market.

There are several recent studies that use choice experiments to analyze food purchasing behaviour. Often, these choice experiments are hypothetical, meaning that there is no actually product being bought and sold. Loureiro and Umberger (2007) used choice experiments to analyze consumers' preferences and willingness to pay for country-of-origin labeling, farm traceability, and food safety inspections when

purchasing steaks in the United States. Each of these attributes is represented by a label on the steak product packaging. They also included tenderness and price of the steak as attributes in the choice experiment. They estimated a multinomial conditional logit model and use ratios of the attribute coefficient over the price coefficient to estimate willingness-to-pay for each attribute. Their results show that consumers were willing to pay the most for a steak with a label guaranteeing that it was inspected by the USDA, Food Safety Inspection Service (Loureiro and Umberger, 2007). Goldberg and Roosen (2007) compared the contingent valuation method with choice experiments. The contingent valuations questions were dichotomous choice questions that asked participants how much they were willing to pay for varying levels of food safety when buying chicken breasts. Each respondent was also given eight choice sets. They used a random utility model to analyze the results of the choice experiment. They found that the choice experiments resulted in a higher values of willingness-to-pay for attribute packages (Goldberg and Roosen, 2007). Carlsson, Frykblom, and Lagerkvist (2007) conducted a choice experiment on Swedish consumers. They analyzed consumer behaviour when buying chicken and beef. They included several attribute such as herd living conditions (indoor or outdoor), transport and slaughter, price. The attribute of interest was the animals' fodder. It could be non-genetically modified, genetically modified, or they could be a ban on genetically modified foods in the European union and so it is obviously non-genetically modified. They used a random parameter logit model to analyze the responses. They found that consumers preferred the non-genetically modified food and that there was no significant difference between their willingness to pay for a ban on genetically modified food when compared to a mandatory labeling

system where genetically modified foods are allowed but must be labeled (Carlsson, Frykblom, and Lagerkvist, 2007).

Some choice experiments are nonhypothetical. The advantage of nonhypothetical experiments is that the participants may be encouraged to answer the survey truthfully, since they will actually be paying for the product and taking it home at the end of the experiment. The disadvantage is that the product must actually exist with the stated attributes. Non-existing attribute levels may still be included. For example, a label that does not exist can still be attached to a product. Also, price levels that you would not see on the market can be tested. Lusk and Schroeder (2004) compare responses from a hypothetical choice experiment to that of a nonhypothetical choice experiment. The only difference between the two treatments was whether the payment was actually required at the end of the session or not. They used beef steaks as the product in their experiments. Five steaks with varying prices were presented at each question. This is different that most of the other choice experiments, which had a choice between only two products per question. They used multinomial logit models to analyze their data. They found that the willingness-to-pay values were larger for the hypothetical group. This makes sense, since people would generally be more careful about their decisions when real money is involved (Lusk and Schroeder, 2004).

Nayga, Woodward, and Aiew (2006) use a nonhypothetical choice experiment to analyze consumers' willingness-to-pay for safer meat through irradiation. Information about irradiation techniques and effectiveness were given to each participant before making the choices. The setting was made as real as possible by having the meat available for viewing and using real cash for the transactions. They developed single-

bounded and one and one-half bounded models. They found that the cost of irradiating the meat was less than the premium their respondents were willing to pay for irradiated ground beef.

Methods

This study implements a survey that includes a purchase simulation in the form of choice experiments. Participants are asked to choose between a high fat snack food and a healthier snack food. Some of these less healthy snack foods have a stigmatizing label stating that the product has been taxed due to its less healthy nutritional content. Two types of warning labels are used. One is designed with a red circle, which represents a stop light. The text reads, "This product is high in fat. It has been taxed due to its less healthy nutritional content. Health Canada." The other has the same design as the warning text on cigarette packages. It reads, "WARNING. Excessive consumption of this product may lead to obesity and associated health problems. This product has been taxed due to its less healthy nutritional content. Health Canada." The effectiveness of different types of labels are compared. The choice experiment questions test different price levels so the interaction between price and stigmatizing label can be estimated. Demographic questions are also included in the survey in order to compare responses across demographic groups. In focus groups and early pretests a third label, which was a subscript on the Nutrition Facts panel was also used. People sometimes did not notice this warning. For our purposes, we decided to exclude this warning design from the rest of the study.

We conducted two focus groups, one in September and another in October, in

order to test and refine the draft survey instrument. The discussions in the focus groups helped with editing of the questionnaire. Also, we were able to discuss the participants' responses to each warning label. The focus groups suggested that some people's purchasing decisions are heavily affected by nutrition and warning labels while others' are not affected at all. Our study will help up understand which demographic groups are more likely to respond to such interventions.

Once appropriate revisions to the survey were completed we began to conduct pretests. Our first two rounds of pretesting involved only the choice experiment questions and excluded all demographic questions. The purpose of these pretests were to test different attribute levels and methods of setting up the choice experiments. We tested giving people a warning label on every question while another group saw no warning labels. We also tested mixing warning label types and no warning labels to each participant. In the third pretest, we decided to include the full survey including demographics. We also included the Multidimentional Health Locus of Control scale as first described by Wallston, Wallston, & DeVellis (1978). The design of the choice experiment section for this pretest was to give four choice experiment questions without warning labels followed by four choice experiment questions with warning labels.

The first three rounds of pretesting were all done using paper copies of the surveys given to undergraduate students at the University of Alberta. Electronic pretesting using mod_survey is scheduled for April. We hope to begin data collection in May and have all the data collected by the end of June.

Results

Results from the first round of pretesting suggest that consumers are less likely to choose a product when it has a stigmatizing warning label attached to it. A logit analysis, with the dependant variable being whether or not the snack was chosen, indicates that consumers may associate stigma more to some labels than others. For example, people were less likely to choose a product with a label similar to the warning label on a cigarette package (coefficient = -.91) than a product with a red traffic light-style warning label (coefficient = -.64).

The data obtained from the third round of pretesting was analyzed using a multinomial logit (MNL) model in NLOGIT 4.0 (see appendix for output). There were a total of 29 usable surveys, each participant answering 8 choice experiment questions. This simple preliminary analysis gives us insight into the relationship between a person's decision of whether to purchase a product and the price of the snack food as well as the different warning labels on the packaging. We control for brand by placing dummy variables for the different products into the utility functions. As expected, price has a large negative effect on choice (p=.0048), i.e. the higher the price, the less likely the product is to be chosen. Also, the cigarette package style warning label displayed a significant negative effect on choice (p=.037), while the red-light style warning label also displayed a negative effect, but not as significant (p=.107). The full output can be seen in the appendix. The next step is to analyze the interaction between price and warning labels in order to get insight into the nature of the stigma from the warning labels.

Consumers are less likely to choose a product when it has a stigmatizing warning label attached to it. We expect that some methods of identifying the tax are associated

with more stigma than others. Analysis of the survey responses will allow us to separate the effect of stigma from the price change, as well as understand the joint effects.

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Appendix

NLOGIT 4.0 output for the multinomial logit regression.

```
+---------------------------------------------+
| Discrete choice and multinomial logit models|
+---------------------------------------------+
Normal exit from iterations. Exit status=0.
+---------------------------------------------+
| Discrete choice (multinomial logit) model   |
| Maximum Likelihood Estimates                |
| Model estimated: Apr 11, 2008 at 02:51:38PM.|
| Dependent variable                Choice    |
| Weighting variable                  None    |
| Number of observations             232      |
| Iterations completed                 6      |
| Log likelihood function       -202.4941     |
| Number of parameters                11      |
| Info. Criterion: AIC =          1.84047     |
|   Finite Sample: AIC =          1.84564     |
| Info. Criterion: BIC =          2.00389     |
| Info. Criterion:HQIC =          1.90637     |
| R2=1-LogL/LogL*  Log-L fncn  R-sqrd  RsqAdj |
| Constants only.  Must be computed directly. |
|                  Use NLOGIT ;...; RHS=ONE $ |
| Response data are given as ind. choice.     |
| Number of obs.=   232, skipped   0 bad obs. |
+---------------------------------------------+

+---------------------------------------------+
| Notes No coefficients=> P(i,j)=1/J(i).      |
|       Constants only => P(i,j) uses ASCs    |
|         only. N(j)/N if fixed choice set.   |
|         N(j) = total sample frequency for j |
|         N    = total sample frequency.      |
|       These 2 models are simple MNL models. |
|       R-sqrd = 1 - LogL(model)/logL(other)  |
|       RsqAdj=1-[nJ/(nJ-nparm)]*(1-R-sqrd)   |
|         nJ   = sum over i, choice set sizes |
+---------------------------------------------+
+--------+--------------+----------------+--------+--------+
|Variable| Coefficient  | Standard Error |b/St.Er.|P[|Z|>z]|
+--------+--------------+----------------+--------+--------+
 PRICEP  |   -1.21432116       .43074494    -2.819   .0048
 WARN1   |    -.58541149       .36315747    -1.612   .1070
 WARN2   |    -.88898896       .42569642    -2.088   .0368
 PROD1   |   -2.10034922       .53187389    -3.949   .0001
 PROD2   |    -.78322083       .43715960    -1.792   .0732
 PROD3   |    -.78042654       .41733372    -1.870   .0615
 PROD4   |    -.20387530       .38213807     -.534   .5937
 PROD5   |   -1.53844866       .41705506    -3.689   .0002
 PROD6   |    -.33741829       .40762423     -.828   .4078
 PROD7   |     .49153516       .42097030     1.168   .2430
 ASCC    |   -3.30385249       .71170571    -4.642   .0000
```