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Reduction in purchases of energy-dense nutrient-poor foods in Mexico associated with the introduction of a tax in 2014

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ABSTRACT

In 2014, an 8% tax on energy-dense nutrient-poor foods was implemented in Mexico with the aim of reducing its consumption. This paper estimated changes in household purchases of taxed food.

We used the latest five waves of the nationally representative Mexican Income and Expenditure Survey (2008, 2010, 2012, 2014 and 2016). The analytic sample comprises 154,777 households. We estimated changes in purchases based on a before and after comparison.

Results show a reduction in purchases of taxed food of −5.4 g/week per capita, equivalent to a relative reduction of −5.3% in the 2014 and 2016 waves compared to the 2008, 2010 and 2012 rounds. The largest relative reductions were in urban areas (−6.9%), among households with children (−7.0%), households where the head had an intermediate educational level (−9.9%) and the southern region (−14.8%). We did not find a significant reduction in rural areas.

While there is a large heterogeneity, the fiscal instrument has been effective in reducing taxed food purchases and has generated substantial revenue that could be used to finance policies for the prevention and treatment of obesity.

1. Introduction

Obesity is a disease affecting around 641 million people globally in 2014 (NCD Risk Factor Collaboration (NCD-RisC), 2016). In Mexico, the National Health and Nutrition Surveys conducted between 1988 and 2012 showed a rapid and large increase in the prevalence of overweight and obesity in all age groups, particularly in women of childbearing age (Gutiérrez et al., 2012; Barquera et al., 2013).

Obesity is associated with an increased risk of chronic diseases (World Health Organization, 2015). Although obesity is multifactorial in origin, there is evidence of a positive association between the consumption of energy-dense micronutrient-poor foods (normally high in saturated fat, salt and/or sugars) and weight gain (World Health Organization/Food and Agriculture Organization, 2002). The consumption of these foods is also associated with high blood pressure and atherosclerosis (Rauber et al., 2015), conditions that are risk factors for other chronic diseases.

A high proportion of the Mexican population has a low-quality diet, i.e., does not meet international recommendations (Rivera et al., 2016; Batis et al., 2016a). Moreover, a study estimated that in 2012, foods high in saturated fat or added sugars contributed on average 16% to total energy intake (Aburto et al., 2016).

Several food policies have been proposed to reduce the consumption of unhealthy food and beverages, including taxes (World Health Organization, 2013). In addition to a tax on sugar sweetened beverages, since January 2014 in Mexico an ad valorem tax of 8% was applied to energy-dense nutrient-poor foods with an energy density ≥275 kcal/100 g (Congreso de los Estados Unidos Mexicanos, 2014). These food items (denoted as nonessential energy-dense food in the legislative jargon in Mexico and referred from now on as taxed food) include chips and deep-fried salted snacks, sugar confectionery, chocolates, crème caramel and puddings, candied fruits, peanut and hazelnut spreads, caramel sauces, cereal-based sweet foods, ice cream and popsicles. It is estimated that these foods contribute on average 14.4% to the total energy intake of the population (Batis et al., 2017).

A recent study estimated changes in purchases of packaged foods,

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among a panel of representative Mexican households in cities of over 50,000 inhabitants (Batis et al., 2016b). The study found an average 5.1% reduction in the volume of taxed food purchases in the first year after the tax (2014) compared to what would had been expected according to pre-tax trends. The study also found that the reduction was greater in households with a lower socioeconomic status. A more recent study, based on the same panel and using a similar methodology, estimated an overall 6% reduction two years after the tax was implemented (2014–2015) (Taillie et al., 2017). Although this panel of households was longitudinal and had enumerators visiting households every 2-weeks to collect purchases, it only captured packaged foods, and excluded some food items, like candies and chocolates. An additional limitation of the study was that the data did not include households in more rural areas.

The aim of this paper was to estimate changes in household purchases of taxed food in a representative sample of the Mexican population. We used six rounds of the National Income and Expenditure Surveys. The analysis was based on a before and after comparison using a two-part model to account for the large number of non-purchases. We analyzed the heterogeneity of changes in purchases by household income, presence of children at the household, education level for the head of the household, and area of residence (urban/rural).

2. Methods

2.1. Data sources

We analyzed the National Household Income and Expenditure Surveys (ENIGH), in its 2008, 2010, 2012, 2014 and 2016 waves. The ENIGH is a cross-sectional survey carried out every two years between August and November. The survey has a probabilistic, two-stage stratified clustered design, and it is representative both at the national level and of urban and rural strata (Instituto Nacional de Estadística y Geografía, 2013).

The ENIGH collects information on household expenditures in 242 food, beverage, and tobacco categories, which do not include expenditures on food services for consumption away from home. Household expenses on food and beverages are obtained with a daily record instrument which is applied during seven consecutive days (Instituto Nacional de Estadística y Geografía, 2015). Non-monetary expenses related to assets obtained as gifts, at subsidized prices, or produced in a family business are also collected. Quantity purchased corresponding to each expense is recorded. The ENIGH also reports household income and collects sociodemographic information such as household composition, level of education of the head of the household and area of residence (urban/rural).

2.2. Identification of food groups and analytic sample

The categories in the ENIGH are composed by 1) a single food, for foods that are widely consumed (e.g. tomatoes) or by 2) a food group that includes foods in less demand (for example cherries, raspberries, strawberries and blackberries would make up one category of expenditure). When a category was composed by a food group, we considered the category as “taxed” if the tax affected more than half of the foods in the group, and “untaxed” in the opposite case. A thorough classification into taxed/untaxed would had required information at the brand level because energy density varies by brand; however, this information was unavailable therefore our identification was subject to a certain degree of misclassification. Supplemental Table A.1 shows the categories classified as taxed/untaxed. We classified 14 categories of food expenditure in ENIGH as taxed, and we grouped them into four subgroups: sweet bread from large bakeries, chips and salty snacks, candies and chocolates, and cereal-based sweet food.

Sweet bread from bakeries is a particular subgroup because small producers, those with lower annual income, could have benefitted from a fiscal stimulus applied to micro and small enterprises, which was equivalent to a 100% reduction (“Diario Oficial de la Federación,” 2013), thereby undermining the ability of the tax to increase prices. This consideration is important because small bakeries have a 55% market share (Excelsior, 2014). We could not identify purchases from bakeries that took advantage of the fiscal stimulus, but we used information from the survey on the type of establishment in which purchases were made. With this information, we could classify units of sweet bread from a traditional retailer or specialized bakery stores (referred to from now on as “sweet bread from small or specialized bakeries”) separately from sweet bread from large bakeries that were definitely taxed (such as supermarkets, department stores, warehouse clubs, convenience stores and restaurants).

We considered important to estimate changes in the group of untaxed food composed of the remaining 186 food categories, to see if our findings on taxed food could have been the result of a general trend in total food purchases. We divided categories by ultra-processed untaxed (26 categories), and non-ultra-processed (160 categories) foods, following the NOVA classification criteria. The NOVA classification categorizes foods according to the extent and purpose of food processing rather than in terms of nutrients (Monteiro et al., 2016), to identify possible substitutions.

We excluded households without purchases in any food category and those who reported a zero income, which represented $< 0.9\%$ of households with completed interviews for each wave of ENIGH. The analytic sample comprised of 154,777 households (29,222 households in 2008, 27,414 in 2010, 8926 in 2012, 19,360 in 2014 and 69,855 in 2016).

We excluded quantities associated with non-monetary expenses. We considered that these purchases could not be affected by the tax in the same way as monetary expenses because they did not imply a food choice under market prices. Non-monetary expenses made up approximately one-fifth of the monetary expenses on food in each wave, so we included them in the sensitivity analysis. We also conducted a sensitivity analysis that excluded households with taxed food purchases above the 99th percentile in the set of households with non-zero purchases, because the corresponding per capita quantities could be considered implausible for individual consumption.

2.3. Statistical analyses

The tax was applied nationally, so there was not a straightforward comparison group. We estimated changes in household purchases associated with the tax through a before and after approach, comparing purchases in a period prior to the application of the tax (2008–2012) with purchases in a period where the tax was in force (2014–2016), adjusting for variables that change over time and could potentially influence food purchases.

For each household in the analytical sample, we calculated the per capita quantity in grams of weekly purchases by dividing total household quantities by household size, both for taxed food, untaxed food, and for each subgroup. We estimated the average quantities of groups and subgroups as the weighted average of per capita quantities, taking into consideration the complex sample design of the ENIGH.

The percentage of households that did not report purchases of taxed food in each ENIGH wave was very high (~60%), so we followed a two-part estimation strategy (Belotti et al., 2015). We first modeled the probability of purchasing as a function of a binary variable indicating the taxed or pre-taxed period (0 = 2008, 2010, 2012; 1 = 2014, 2016), adjusting for demographic, socioeconomic, and contextual covariates. In the second part, we estimated a generalized linear model with log-link and gamma distribution on households with positive taxed food purchases, adjusting for the same variables as the first part. Changes in purchases were calculated as the average marginal effect of the variable indicating taxed or pre-taxed period, considering both parts of the model (i.e. multiplying the predicted probabilities and quantities).