Price elasticity of the demand for sugar sweetened beverages and soft drinks in Mexico

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ARTICLE INFO

ABSTRACT

A large and growing body of scientific evidence demonstrates that sugar drinks are harmful to health. Intake of sugar-sweetened beverages (SSB) is a risk factor for obesity and type 2 diabetes. Mexico has one of the largest per capita consumption of soft drinks worldwide and high rates of obesity and diabetes. Fiscal approaches such as taxation have been recommended as a public health policy to reduce SSB consumption. We estimated an almost ideal demand system with linear approximation for beverages and high-energy food by simultaneous equations and derived the own and cross price elasticities for soft drinks and for all SSB (soft drinks, fruit juices, fruit drinks, flavored water and energy drinks). Models were stratified by income quintile and marginality index at the municipality level. Price elasticity for soft drinks was −1.06 and −1.16 for SSB, i.e., a 10% price increase was associated with a decrease in quantity consumed of soft drinks by 10.6% and 11.6% for SSB. A price increase in soft drinks is associated with larger quantity consumed of water, milk, snacks and sugar and a decrease in the consumption of other SSB, candies and traditional snacks. The same was found for SSB except that an increase in price of SSB was associated with a decrease in snacks. Higher elasticities were found among households living in rural areas (for soft drinks), in more marginalized areas and with lower income. Implementation of a tax to soft drinks or to SSB could decrease consumption particularly among the poor. Substitutions and complementarities with other food and beverages should be evaluated to assess the potential impact on total calories consumed.

1. Introduction

The prevalence of overweight and obesity has reached alarming rates in Mexico. In 2012, 73% of adult women, 69% of adult men and more than 30% of children and adolescents were overweight or obese (Instituto Nacional de Salud Pública, 2012; Barquera et al., 2013). Mexico ranks second on obesity and first on diabetes prevalence of all country members of the Organization for Economic Co-operation and Development (OECD, 2011; Hernádez-Ávila et al., 2013).

Although the obesity epidemic is caused by multiple and complex factors, there is an increasing and stronger evidence that consumption of sugar-sweetened beverages (SSB) is a risk factor for obesity, type two diabetes and heart disease (Malik et al., 2006; Vartanian et al., 2007). Consumption of sugar in beverages does not produce satiety compared to sugar in a solid form, which tends to stimulate overconsumption of SSB (Willett and Ludwig, 2013). Most systematic reviews of prospective cohorts and randomized trials, show positive associations between the consumption of SSB and adult weight (Malik et al., 2006, 2009; Vartanian et al., 2007; Te Morenga et al., 2013) and risk of type 2 diabetes (Malik et al., 2010; InterAct, 2013).

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Consumption of SSB such as soft drinks, juices, vitamin water, energy drinks and fruit drinks has significantly increased worldwide (Popkin, 2012). In Mexico, average individual consumption of SSB increased 60% between 1989 and 2006 (Barquera et al., 2008). In 2011, Mexico had the largest per capita consumption of soft drinks worldwide estimated at 163 l per capita per year (Euromonitor, 2011). The largest consumption of soft drinks is concentrated in the age range between 12 and 39 and is particularly high in the population aged 19 to 29 (Barquera et al., 2008). Recent evidence from the 2012 National Health and Nutrition Survey shows that caloric beverage represent about 18% of total energy among children and adults (Stern et al., 2014), 71% of the consumption of added sugar in Mexico comes from SSB and at least 66% of the population consumes more than 10% of added sugars – above the WHO recommendation – (Sánchez-Pimienta, 2015). While there is evidence from the National Income and Expenditure Surveys of a slight decrease in the percent of households that report any expenditures on SSB between 2008 and 2010, consumption in the country it is still very high (Euromonitor, 2011).

Fiscal approaches to reduce SSB consumption and the risk of obesity, diabetes and other chronic diseases such as taxation have been implemented or proposed in at least 19 countries around the globe (Jou and Techakehakij, 2012). Three considerations to implement taxes to SSB have been described: externalities related to increased health care costs associated with consumption of unhealthy beverages; information asymmetry in SSB advertisement—particularly among children; and, the use of revenues to benefit groups that are more affected by the health consequences of consuming SSB or to compensate the poor if the tax is regressive (Brownell et al., 2009). At the moment, there is no evidence of the effectiveness of a tax to SSB on consumption in the countries where it has been implemented (such as France or Denmark). The current paper is an estimation of the potential effect of a tax on consumption in Mexico. Taxes to SSB can have a direct effect on consumption and be an effective measure particularly in countries with high rates of obesity and high levels of SSB consumption (Jou and Techakehakij, 2012).

Evidence of the potential effect of a tax on consumption may inform the decision to implement a fiscal policy in the country. Estimation of substitution effects (an increase in the consumption of beverages or high-energy dense food not affected by changes in their own prices in response to the price increase on another – presumably taxed – beverage) are key given that the potential decrease on consumption and its positive effects on health induced by a tax could be offset by an increase in the consumption of other beverages with high sugar content or high-energy food.

Previous estimates in Mexico show price elasticities of the demand for soft drinks ranging between −0.6 and −1.6: a 10% increase in the demand for SSB is associated with a decrease in consumption between 6 and 16% (Valero, 2006; Barquera et al., 2008; Urzúa, 2008; Unar et al., 2013). This wide variation can be partly explained by the year studies were conducted, the type of SSB analyzed (some estimated the price elasticity of soft drinks whereas others mix soft drinks, juices and other SSB), the different

empirical models applied as well as the data sets used. Our paper adds to the existing literature the application of a linear approximate almost ideal demand system (LA/AIDS) to derive price elasticities that includes beverages and high-energy foods as potential substitutes. The LA/AIDS model we used is consistent with the economic theory, it allows testing the condition of homogeneity and symmetry through linear restrictions on fixed parameters (Deaton and Muelbauer, 1980) and has more accurate estimations either implementing seemingly unrelated regressions or three stage least square (Alston et al., 1994). A comparison of different demand system models shows that the LA/AIDS model performs as good as other systems when estimating income and price elasticities, and have low standard errors specially when the number of commodities estimated is very large ($n \geq 6$) (Meyer et al., 2011). In addition, we used the most recent data available in the country and provided price elasticities of the demand for soft drinks and SSB stratified by income and marginality level to explore the potential heterogeneous impact of a tax. The rationale for stratifying by marginality index is as follows. The price elasticity of the demand for SSB may vary by marginality area, regardless of household income, as the demand for any food or beverage depends on availability and diversity of brands as well as availability of potential substitutes. The specific aims of this study were to estimate the own and cross price elasticities for soft drinks and for all SSB (soft drinks, fruit juices, fruit drinks, flavored water and energy drinks). The models were stratified by household income quintile and marginality index at the municipality level. Price elasticities were estimated using the 2006, 2008 and 2010 Mexican National Income and Household Expenditure Surveys (MNHIES). Analyzing the potential effect of a tax to soft drinks provides evidence to evaluate the feasibility of fiscal approaches to reduce SSB consumption.

2. Methods

2.1. Data sets

The MNHIES, conducted by the Mexican National Institute of Statistics and Geography (INEGI), is a system of cross-sectional nationally representative surveys with a two stage stratified probabilistic design (Instituto Nacional de Estadística y Geografía, 2011). The surveys are conducted every two years and collect household information on income and expenditures as well as household characteristics and socio-demographic data of their members. The MNHIES gathers daily food and beverage expenditures for one week, including the monetary value of gifts, transfers and consumption of household produced foods. While the individual responsible for reporting the data records every transaction, she or he is also asked to get the information for other members of the households. In this paper, we used the 2006, 2008 and 2010 waves. All the three waves were conducted from the third week of August to the first week of November.

2.2. Empirical model

We estimated a demand system for beverages and food using the Linear Approximation of the Almost Ideal