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# LEARNING FROM THE MEXICAN EXPERIENCE WITH TAXES ON SUGAR-SWEETENED BEVERAGES AND ENERGY-DENSE FOODS OF LOW NUTRITIONAL VALUE

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DISCUSSION PAPER

JUNE 2016

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WORLD BANK GROUP
Health, Nutrition & Population

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## ***Poverty and Social Impact Analysis***

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## Health, Nutrition and Population (HNP) Discussion Paper

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# Health, Nutrition and Population (HNP) Discussion Paper

## Learning from the Mexican Experience with Taxes on Sugar-Sweetened Beverages and Energy-Dense Foods of Low Nutritional Value

### *Poverty and Social Impact Analysis*

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**Abstract**: Faced with a large and increasing obesity epidemic, the Mexican Government in the last years has increased efforts to prevent and control it. In October 2013, Mexico's Congress passed legislation imposing taxes on sugar-sweetened beverages (SSBs) and calorie-dense foods of low nutritional value. These taxes were part of a comprehensive strategy to prevent and control obesity, overweight and diabetes. In addition to fiscal policy and regulation, this strategy included other health promotion and prevention interventions as well as measures to ensure better access to effective health care services. The decision to implement this fiscal policy was the result of a long advocacy process in which different actors participated, including civil society organizations and government agencies, which provided needed evidence on the status of the epidemic and options to fight against it. The taxes were designed to avoid, as much as possible, the substitution of consumption of the taxed goods for other unhealthy foods and beverages not subject to taxation. These taxes have been successful in increasing both the fiscal revenues and the price of the products taxed. There is also evidence that they have reduced consumption, particularly of SSBs. The taxes seem to have the highest impact among people in the poorest quintiles of the income distribution, who had experienced the highest increase in consumption of the goods under taxation in the last years. A debate remains on the actual impact of the taxes, particularly on health outcomes. Thus it is important to continue monitoring the impact of the taxes through the development of price and volume indicators, based on publicly available data, as well as health outcome indicators.

**Keywords**: taxes, sugar-sweetened-beverages, diets, obesity, Mexico.

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# EXECUTIVE SUMMARY

Mexico faces a major health and economic burden due to the large and increasing number of adults and children suffering from overweight and obesity. More than two-thirds of adults are overweight or obese and at least a third is obese. The country has the second largest adult obesity rate among OECD countries.

Obesity is one of the main risk factors for the development of some non-communicable diseases, especially diabetes and cardiovascular diseases, which are the main causes of healthy life years lost in Mexico. Since these conditions require extended and continuous contact with the health sector and generate large productivity losses, due to premature deaths and workers absenteeism, they also negatively impact the economy of the country.

Faced with this epidemic, the Mexican Government in the last years has increased efforts in the prevention and control of obesity. Among these efforts, in 2013, the Health Secretariat launched a National Strategy for the Prevention and Control of Overweight, Obesity, and Diabetes. One of the main pillars of this comprehensive strategy is the use of fiscal policy to improve diets.

In October 2013, Mexico's Congress passed legislation imposing taxes on sugar sweetened beverages (SSB) and calorie-dense foods of low nutritional value to help slow the country's rising obesity rates and to generate tax revenues. The law went into effect on January 1, 2014, and includes a one-peso-per-liter tax, equivalent to a 10 percent price increase on drinks containing added sugar. It also includes an ad valorem tax equivalent to 8 percent of the value of high-calorie foods of low nutritional value, defined as foods containing 275 kcal or more per 100 grams. These taxes were not only part of the strategy to prevent obesity, but were also part of a comprehensive fiscal reform aimed at increasing tax revenue and reducing the over reliance on oil in government revenues. Both taxes were part of a reform of the Law on the Special Tax on Production and Services (*Impuesto Especial sobre Productos y Servicios* -IEPS).

The purpose of this study is to learn from Mexico's experience in implementing this novel fiscal policy in the fight against obesity. The specific objectives of this work are to: (i) understand the context in which the fiscal policy was enacted; in other words, the reasons behind the Mexican Government's decision to tax SSBs and calorie-dense foods of low nutritional value ; (ii) describe in detail main features of these taxes; (iii) evaluate the design and implementation process of the policy; (iv) take stock of what is known about the impact of these taxes on fiscal revenue, prices, and consumption among different population groups; and (v) provide options to monitor this reform on a regular basis using publicly available data.

There are several reasons behind the decision of the Mexican Government to enact these two taxes as part of a comprehensive strategy to fight obesity. First, there is evidence linking the foods and beverages that are subject to the taxes with an increasing trend in overweight, obesity and other chronic conditions. These products tend to be rich in calories but provide little nutritional value. In addition, the consumption of these products had been increasing fast over the years; indeed Mexico is one of the countries in the world with the highest consumption of SSBs. Within Mexico, high-income families have been consistently more likely to consume SSBs than low-income families; however, it is the low-income families (in quintiles I and II) that experienced the steepest increase in consumption over the years. Finally, although this fiscal policy is novel, there is limited but increasing evidence from other countries that these taxes can have a negative impact on consumption of taxed goods.

The decision to implement this fiscal policy was the result of a long advocacy process in which different actors participated, including civil society organizations and government agencies such as the National Institute of Public Health, which provided needed evidence on the status of the epidemic and options to fight against it. These efforts resulted in the enactment of these two taxes as part of the overall fiscal reform that Congress approved at the end of 2013.

The taxes were designed to avoid as much as possible the substitution of consumption of the taxed goods for other unhealthy foods and beverages not subject to taxation. For instance, the tax on SSBs includes all beverages with added sugar and includes a broad definition of sugar (monosaccharides, disaccharides and polysaccharides) to include table sugar, high fructose corn syrup, and other high caloric sweeteners.

These taxes have been successful in increasing fiscal revenues and the price of the products taxed. There is also evidence that they have reduced consumption, particularly of SSBs. However, there is still a debate about the nature and extent of this impact, particularly on health outcomes.

A review of the studies conducted so far on the impact of the reform on prices (Grogger (2015) and Colchero et al. (2015b)), including our analysis, highlight the following: (i) the prices of soda drinks tended to increase by the amount of the tax or more; (ii) prices of smaller packages of the taxed products increased more than 1 peso per liter and larger packages increased around 1 peso; (iii) other SSBs (flavored waters and industrialized juices) increased by less than 1 peso; (iv) it is not clear whether diet soda prices were affected by the tax; and (v) there were regional differences on price setting.

When comparing the prices of SSBs in Mexico after the tax reform with comparison countries like Argentina and Brazil, the prices in Mexico remain relatively low, which make these goods more affordable in Mexico than in those two countries. This suggests there may be additional room to increase prices and possibly achieve a larger impact on reducing consumption.

Our own analysis of the price structure of SSBs in Mexico before and after the tax shows that the price differences between competing brands (that is, among cola soft-drinks) and the different types of sodas (cola and flavored sodas) were high before the fiscal policy was enacted, and that the tax increase was not large enough to move the entire price structure up. It was reasonable to expect that consumers could purchase cheaper versions of the taxed product at almost pre-tax levels. For example, in December 2013, before the taxes came into effect, the 2 liter Coke bottle was on average MXN 19.5 while that of Pepsi was MXN 15.6. Also, the price of the 2 liter Fanta bottle was almost 4 pesos cheaper than that of Coke. In December 2015, two years after the reform, the 2 liter Pepsi bottle was MXN 19.8, similar to the price of the 2 liter Coke bottle before the reform, while the 2 liter Fanta bottle was cheaper (about MXN 18).

In addition, before the reform, a liter of the cheapest presentation of Coke averaged MXN 9.3 to the Mexican consumer. After more than two years of the reform, it is possible to buy, through large sale promotions, one liter of cola and flavored sodas with MXN 4.4 in Mexican supermarkets. For those consumers able to buy at these sale promotion prices, the tax reform has not drastically changed the financial incentives to reduce the consumption of regular sodas.

In terms of volumes purchased, existing studies, for instance Colchero et al. (2016) found that the post-tax purchases of SSBs during the first year were 6 percent lower on average than the pre-tax trend. They also found that purchases of untaxed beverages (mainly bottled water) were 4 percent higher. They found that the reduction in purchases of non-carbonated taxed beverages was larger than the reduction in carbonated taxed beverages. This could be due to higher prices and high price elasticities of non-carbonated beverages; and consumers shifting to lower priced versions of taxed carbonated beverages given the large variation in prices. They also found that the largest impact on consumption was among households of low socioeconomic level.

Another study published by ITAM (Aguilar et al., 2016) found that the tax appeared to have incentivized moderate reductions in consumption of SSBs. The tax on SSBs, contrary to what was found by the previous study, appears to have had a greater effect among households in the higher income level. As per the taxes on high-calorie foods, in order to control for potential product substitution resulting from the taxes, the researchers studied the total calories consumed (taxed and untaxed foods). They found a weekly decrease in calorie consumption of 1 percent. In their measures of BMI (Body Mass Index), the researchers found no discernible difference across the years under examination, which is in line with the small impact seen for calories consumed.

Our analysis also used a series of the National Household Income and Expenditure surveys to observe the behavior of consumption before and after the tax. These data have limitations to study the impact of the taxes; however, the data provide some insight on the possible direction of the changes and who could have been more affected by the tax. The descriptive analysis of the data shows a reduction in the percentage of households that purchased and consumed SSBs between 2012 and 2014; this is particularly the case among households in the poorest three income quintiles. It also showed a significant increase in the percentage of households that purchased bottled water and, among the poorest 20 percent of households, there was a significant increase in the percentage of families that bought milk. The data also show slight decreases in the consumption of some foods of low nutritional value within households.

The data also show a significant decrease in the per capita consumption of SSBs and an increase in per capita consumption of bottled water. Regarding the second tax, the percentage of households that purchased energy-dense foods of low nutritional value, such as cookies, jellies and candies slightly decreased from 2012 to 2014. The decrease in per capita consumption however was not statistically significant.

Regression analysis of the demand for foods and beverages subject to the taxes shows that the own-price elasticity of demand of SSBs is inelastic. This might be partly due to the imprecise definition for SSBs used in this study since it was not possible to distinguish sodas, juices and other flavored beverages with and without added sugars. However, when we look at the demand of sodas, which are more likely to have added sugar (the market for light or low calorie versions is small in Mexico), the own-elasticity of demand becomes more elastic. Across income quintiles, the own-price elasticity of demand of SSBs decreases with income; while the own-price elasticity of demand of sodas is highest among people in the middle of the income distribution.

Fiscal policy used for health promotion purposes is still a controversial issue. These reforms face major risks. They tend to affect a relatively small group of powerful and concentrated businesses with capacity to fight back. In addition, if the tax is small and there is potential for consumption substitution within the taxed products (that is, cheaper brands, cheaper packages within the same brand, or through promotions) the impact of the tax on the consumption of the unhealthy good could be small. Then, policymakers should be aware of the possible resistance and producers and consumers strategies that could reduce the expected impact of the tax. For all these reasons, it is important to continue monitoring the reduction in consumption and consumption substitution (to healthy or unhealthy substitutes). This is possible to do through the development of price and volume indicators based on publicly available data. These indicators are important and it is relatively easy-to-generate tools for the political debate about effectiveness of the reform design and implementation. Mexico faces a major health and economic burden due to the large and increasing number of adults and children suffering from overweight and obesity. More than two-thirds of adults are overweight or obese and at least a third is obese. The country has the second largest adult obesity rate among OECD countries.

# ACKNOWLEDGEMENTS

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# ACRONYMS AND ABBREVIATIONS

ANPEC - La Alianza Nacional de Pequeños Comerciantes
ANPRAC - Asociación Nacional de Productores de Refrescos y Aguas Carbonatadas
BMI – Body Mass Index
CCIs - Chronic Conditions and Injuries
CPI – Consumer Price Index
DALYs – Daily Adjusted Life Years
EMIM - Encuesta Mensual de la Industria Manufacturera
ENIGH - National Survey on Household Incomes and Expenses
ENSANUT – Encuesta Nacional de Salud y Nutrición
EURO – European Monetary Unit
FAO – Food and Agriculture Organization
FEMSA - Fomento Económico Mexicano, S.A.B. de C.
GDP – Gross Domestic Product
GDP – Gross Domestic Product
HDL – High-density Lipoprotein
HFCS - High Fructose Corn Syrup
HUF – Hungarian Forint Regional Currency
IEPS - Impuesto Especial Sobre Productos y Servicios
IESPS - Impuesto Especial Sobre Productos y Servicios
INEGI – Instituto Nacional de Estadística y Georgrafía
ITAM – Instituto Tecnológico Autónomo de México
ITAM - Instituto Tecnológico Autónomo de México
MXN – Mexican New Peso
NAICS – North American Industrial Classification System
NCD – Noncommunicable Diseases
NGO – Non-governmental Organization
NSO – National Statistical Office
OECD – Organization for Economic Cooperation and Development
OMENT – Observatorio Mexicano de Enfermedades No Transmisibles
PAN - Partido Acción Nacional
PRD – Partido de la Revolución
PRI – Partido Revolucionario Institucional
PRODECON – Procuraduría de la Defensa del Contribuyente
SEP – Secretaría de Educación Pública
SHCP – Secretaría de Hacienda y Crédito Público
SS – Secretaría de Salud
SSB - Sugar Sweetened Beverages
TV – Television
VAT – Value-added Tax
WHO – World Health Organization

# I. INTRODUCTION

In October 2013, Mexico's congress passed legislation imposing taxes on sugar sweetened beverages (SSBs) and energy-dense foods of low nutritional value to slow the country's rising obesity rates and to generate tax revenues. The law went into effect on January 1, 2014, and includes a one-peso-per-liter tax, equivalent to an approximate 10 percent price increase on drinks containing added sugar. Milk and some dairy products are excluded from the legislation. It also includes an 8 percent value excise tax on foods of low nutritional value, defined as foods containing 275 kcal or more per every 100 grams. Some foods that fall within this definition but considered basic-foods were exempted, such as corn and wheat tortilla and unsweetened bread.

The Mexican Congress created these taxes as part of a comprehensive fiscal reform that was aimed at increasing tax revenue and reducing the weight of oil in government revenues. Both taxes were part of a reform of the Law on the Special Tax on Production and Services (*Impuesto Especial sobre Productos y Servicios* -IEPS). But the taxes, applied to domestic and imported products, were also part of a broad government plan to counter the growing obesity, overweight and diabetes epidemics in the country. The president had launched the "National Strategy for Prevention and Control of Overweight, Obesity and Diabetes" and the taxes represented one of its main pillars. The strategy's three pillars are: (i) improved public health, (ii) better medical care for patients with chronic diseases, and (iii) increased regulations and fiscal measures to decrease the intake of foods and beverages of low nutritional value. The SSB and nutrient-poor food tax is coupled with other interventions such as regulations on labeling and advertising and is a result of a long period of negotiations between tax authorities, members of the legislative bodies, civil society organizations, and the private sector that took place in Mexico between the mid-2000s and 2013.

Fiscal policies to reduce the consumption of food and beverages that are energy dense and of low nutritional value are relatively novel policies. These policies have been increasingly discussed in the public health arena as possible options to contribute to the fight against the growing trend of obesity around the world. Since these are relatively new policies, the evidence on their impact on prices, consumption, and health outcomes is still limited. In addition, these policies are difficult to enact since they tend to be controversial especially because the products in question are considered harmful only when consumed in high or inappropriate levels. Learning from recent experiences could help close the knowledge gap in this regard.

The purpose of this study is precisely to learn from the recent Mexican experience with the enactment of taxes on sugar-sweetened beverages and energy dense foods of low nutritional value. The specific objectives of the study are to: (i) understand the context in which the fiscal policy was enacted; in other words, what were the reasons behind the Mexican Government's decision to implement these taxes; (ii) describe in detail the main features of these taxes; (iii) evaluate the design and implementation process of the policy; (iv) take stock of what is known about the impact of these taxes on fiscal revenue, prices, and consumption among different population groups; and (v) provide options to monitor this reform on a regular basis using publicly available data.

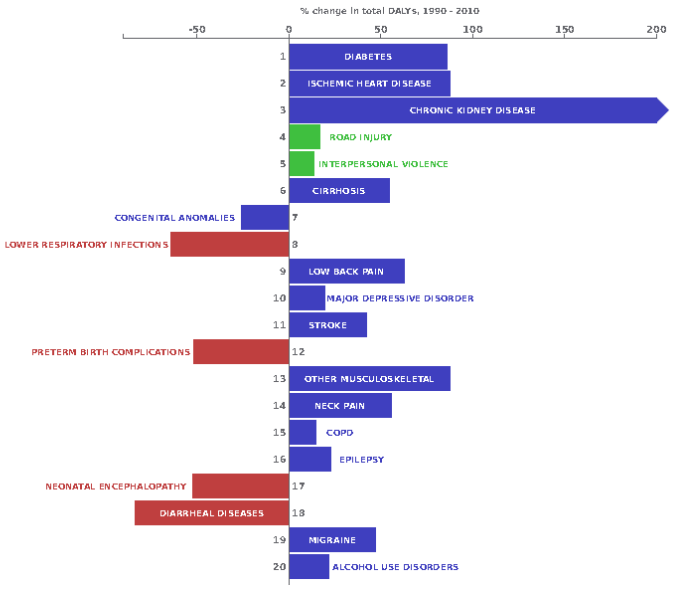
The study is divided into seven sections. After this introduction, there is an overview of the Mexican epidemiological and nutritional transition and the levels of overweight, obesity, and diabetes in the country. This section also provides an overview of the comprehensive strategy the country is currently implementing to prevent and control the epidemic. This is followed by a discussion on the main reasons explaining the decision to include a fiscal policy as part of the Government Strategy to prevent and control overweight, obesity and diabetes. Section four, explains the process to develop and implement these taxes, as well as the detailed features of both tax measures. The last two sections detail what is known about the impact of these taxes on fiscal revenue, prices, and consumption of the goods taxed and that of their substitutes among different population groups. The first of these sections also proposes a framework for the continuous monitoring of the impact of the taxes on prices and volumes of sales. The last section provides the main conclusions of the work.

# II. OVERWEIGHT AND OBESITY IN MEXICO

**Mexico's epidemiological and nutritional transition**

Mexico is confronting an obesity epidemic that is threatening to undermine the country's economic and social wellbeing, since this condition is one of the main risk factors for diabetes and other chronic conditions. [1,2] Indeed, chronic conditions and injuries (CCIs) currently represent the main causes of death and disability in the country. With improvements in child and maternal health and the control of communicable diseases, life expectancy in Mexico has increased. This aging of the population, combined with changes in diet, physical activity, tobacco use and alcohol abuse has resulted in large shifts in the burden of disease of the population. Currently CCIs, such as diabetes and ischemic heart disease are the main causes of healthy life years lost in Mexico (Figure 1). These conditions also generate a large economic burden to Mexican households and the health sector since they require continuous contact with the health system over long periods of time. They also generate large productivity losses due to premature deaths and workers absenteeism.

**Figure 1: Shift in Leading Causes of DALYs in Mexico, 1990-2010**

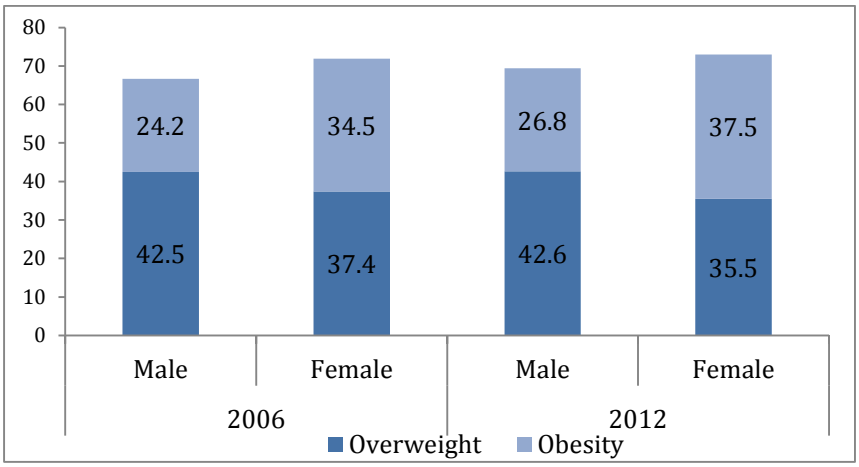



Source: Institute for Health Metrics and Evaluation, Human Development Network, The World Bank. 2013.

Mexico has a "double burden of disease" related to nutrition. Though the rates are declining, the country is still facing challenges with malnutrition caused by nutritional deficiencies such as stunting and anemia.[3,4] At the same time, social and economic progress experienced in the past decades has led to changes in the population's lifestyle and dietary patterns which in turn have led to increased rates of overweight and obesity (Figure 2) and subsequent chronic diseases.

[1] WHO. 2002. http://www.who.int/dietphysicalactivity/publications/trs916/summary/en/.
[2] WHO. 2015. http://www.who.int/mediacentre/factsheets/fs311/en/.
[3] Kroker-Lobos MF et al. 2004.
[4] Uauy R and C.A. Monteiro. 2004.

**Figure 2: Percentage of Adults Overweight and Obese, Mexico 2012**

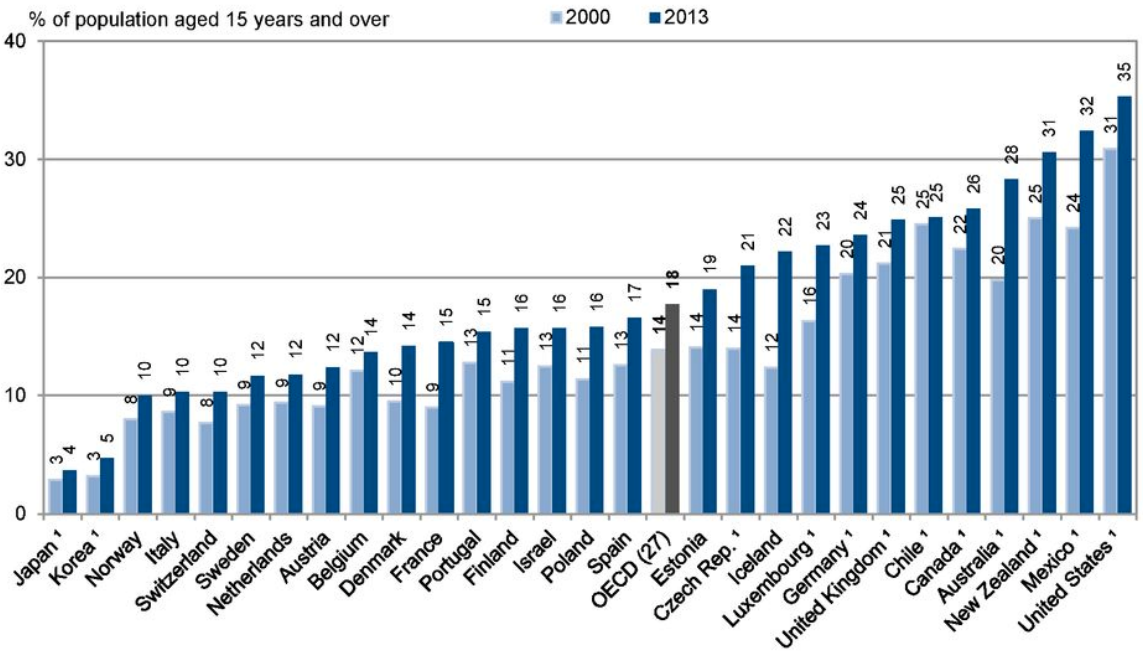



Source: National Health and Nutrition Survey (*Encuesta Nacional de Salud y Nutrición*, ENSANUT) 2012

By 2012, the prevalence rate of obesity and overweight among adults in Mexico was 71 percent (32 percent being obese and 39 percent overweight).[5] In that year, about 40 percent of adult women and 27 percent of men were obese (Figure 2). This condition not only affects adults but also children and adolescents; according to the ENSANUT 2012 survey, 12 percent of girls and 10 percent of boys 6-11 were obese. Mexico had become the second country in the OECD after the USA to have such high obesity rates (Figure 3). Not surprisingly, the prevalence of diabetes had grown rapidly. In 2015, it is estimated that 15.9 percent of the adult population was suffering from the disease, up almost 3 percent since 2011[6] and representing more than double the OECD average of 6.9 percent.[7]

[5] Encuesta Nacional de Salud y Nutrición. 2012. http://ensanut.insp.mx/doctos/analiticos/ObesidadAdultos.pdf
[6] OECD. 2012. http://www.oecd.org/health/49716427.pdf last accessed January 14, 2016.
[7] OECD. 2016. http://www.keepeek.com/Digital-Asset-Management/oecd/social-issues-migration-health/oecd-reviews-of-health-systems-mexico-2016_9789264230491-en#page155,

**Figure 3: Percentage of Adult Population Obese in OECD Countries: 2000 and 2013**




1. Data are based on measurements rather than self-reported height and weight.

*Source*: OECD Health Statistics 2015, http://dx.doi.org/ 10.1787/health-data-en.

Overweight and obesity not only generate an important health burden in Mexico, but also a large negative economic impact. In 2008, it was estimated that the direct costs of obesity in Mexico, due to treatment of 14 complications of four groups of diseases linked to it, reached MXN 42 billion; while its indirect costs, due to productivity losses, reached MXN 25 billion.[8]

**National Strategy for the Prevention and Control of Overweight, Obesity and Diabetes**

Faced with the high prevalence rates of overweight, obesity, and diabetes and their negative consequences on public health and healthcare costs, the Mexican government sought a solution. This is a complex issue since no country in the world has been able to reverse the increasing trend in overweight and obesity among adults.[9] The available evidence shows that in order to stop and reverse the increasing trend not one but a combination of interventions need to be put in place. In this context, the Mexican Government, continuing the efforts started in 2010 with the National Agreements for Food Health (*Acuerdos Nacionales de Salud Alimentaria*), launched the "National Strategy for the Prevention and Control of Overweight, Obesity and Diabetes" in 2013 with its three pillars, further delineated in Box 1. One of the pillars of the strategy is precisely the imposition of fiscal measures, including a tax on SSBs and nutrient-poor foods, coupled with regulations on food labeling and on marketing food and beverages to children. Key aspects of this public health policy were agreements among all stakeholders on cross-cutting actions; the inclusion of health aspects in all public policies; considering the social determinants as the strategy's focus of attention, with a comprehensive approach that includes everything from health promotion to health care services; and the inclusion of measurement of the impact of actions and accountability mechanisms as essential elements for the strategy's proper operation.

[8] Mexico Health Secretariat. 2013.
[9] Global Nutrition Report. 2015.

**Box 1: Mexico' National Strategy for the Prevention and Control of Overweight, Obesity and Diabetes**

**Main objective of the strategy:** "to increase the welfare of the Mexican population and contribute to the sustainability of economic development by stabilizing and reducing the incidence of obesity in order to reverse the epidemic condition of non- communicable diseases (in particular, diabetes) through actions of public health, following an integrated medical model characterized by intersectoral public policies."[1] More specifically, the strategy aims to promote physical activity, improve diets and awareness of nutrition and healthy eating, increase the availability of water, and promote breastfeeding during the first 6 months of life [2].

**Approach:** the Strategy tackles risk factors and social and environmental determinants during the life course. The goal is to develop an integral, multistakeholder plan. The agreement was signed by 15 government agencies in various sectors including health, economic, agricultural, labor, social welfare and social development sectors. NGOs, academia, and food and beverage industry were also involved.

The Strategy is based on **6 principles**: research and scientific evidence, responsibility, transversality, intersectoriality, impact assessment, accountability. The strategy relies on three main pillars:

| Pillars | Strategic Axes | Elements of the Axes |
|---|---|---|
| **I. Public Health:** The strategy aims to promote healthy lifestyles through education and prevention programs like screening for NCD risk factors. The strategy also includes monitoring the incidence of NCDs and its determinants across the population. | ***Epidemiological surveillance of Non Communicable Diseases and its risk factors*** | Information network, creation of an Observatory, definition of indicators of the epidemic, and assessment of impacts. |
| | ***Health Promotion and educational communication*** | Promotion of: healthy nutrition; physical activity; availability of drinking water and vegetables and fruits; ban of advertising of non-healthy foods and encouragement to reduce sugar, sodium and fats in foods. Increased education on healthy nutrition, preparation of material for text books and creation of teachers' networks. |
| | ***Prevention*** | Guidelines for prevention, improvement of early detection of diseases. |
| **II. Health Access:** The strategy aims to increase access to health care for people with NCD risk factors, especially for patients with diabetes. | ***Effective Access to Health Services*** | Equal access to effective coverage: incentives for improvement of treatment. |
| | ***Quality of Health Services*** | Implementation of specific models of care. |
| | ***Improvement of skills and quality of the public health workforce*** | Training on prevention, detection and management of diabetes mellitus type 2, hypertension, metabolic syndrome, chronic kidney disease and dyslipidemia. |
| | ***Infrastructure and Technology*** | IT for prevention and education. |
| | ***Warranty and monitoring of drug supply chain and lab tests*** | IT for improving the drug supply chain. |
| | ***Diabetes Center for design and evaluation of prevention programs and care for patients*** | Development of multidisciplinary care of diabetes. |

| | | |
|---|---|---|
| | ***Bariatric Surgery*** | Improved access to surgery. |
| | ***Scientific evidence and research*** | Financing, management, incentives for scientific research and development of applied research. |
| **III. Regulatory Policy:** The strategy aims to: (a) impose mandatory front labels on products indicating calorie content; (b) pass laws limiting food and drink advertisements targeted for children; (c) impose taxes on high calorie foods and drinks | ***Labeling*** | Uses best international practices; providing information on total energy content and proportion of recommended daily intake; utilization of Pledge classification. |
| | ***Advertising*** | Development of a timetable for advertising bans. Main type of programs are excluded: soap operas, news and sport programs |
| | ***Fiscal Policy*** | Fiscal policies are put in place to reduce consumption of SSBs and high-calorie foods. |

# III. WHY FISCAL POLICY TO PREVENT OVERWEIGHT AND OBESITY?

This section describes some of the reasons behind the Mexican Government decision to enact fiscal policies to contribute to the fight against overweight and obesity. Some of these reasons were: (i) the food and beverages subject to these taxes are calorie-dense but do not provide much nutritional value; (ii) there is evidence linking their consumption with an increasing trend in overweight, obesity and other chronic conditions; (iii) there is evidence showing that these taxes can have a negative impact on consumption; (iv) other countries have recently enacted similar policies with preliminary positive results; (v) their consumption had been growing fast in previous years; and (vi) Mexico is one of the countries in the world with the highest consumption of SSBs.

**Foods and Beverages Subject to Taxes**

Energy-dense foods are foods containing high levels of energy or calories per serving. Some foods are energy dense but are also dense in nutrients, such as vitamins, minerals and proteins. Meats and cheeses for example have high energy content and also contain a lot of nutrients. Other foods have low energy content but are nutrient dense. Examples of these foods are fruits and vegetables. But some foods have high energy content and provide very little or no nutrient content. These are often processed foods such as cookies and candies, as well as some "fast foods".[10]

High calorie intake is not only limited to foods. One of the highest sources of calories are beverages containing high levels of sugar such as soft drinks (sodas) and flavored juice drinks which generally provide low nutritious value.[11] The calories obtained from these are often referred to as "empty calories", the word "empty" referring to their lack of nutritious value.

**Evidence of the Health Impact of Foods and Beverages Subject to Taxation**

The majority of the literature points to an association between SSB intake and noncommunicable diseases, specifically overweight and obesity, and diabetes, the chronic disease most directly linked with obesity. Most meta analyses of randomized controlled trials and prospective cohort studies conducted on the association both in adults and children suggest a link between intake of SSBs and the risk of becoming overweight.[12,13,14,15,16,17] No studies so far have shown a negative association between consumption of sugary drinks and unhealthy weight gain, and the number of studies showing a positive association between the two is increasing. And although most studies have not inferred direct causalities between soda consumption and weight gain (leading to the possible assumption that it is not the soft drink itself that is contributing to body weight gain but soft drink consumption could instead simply be a marker for poorer diet habits) most studies still recommend that soft drink consumption be reduced at the population level to help prevent weight gain and reduce the prevalence of obesity.[18]

High intake of refined carbohydrates such as sugar leads to elevation of triglycerides and blood pressure and lowering of HDL cholesterol, all of which increases the risk of coronary heart disease. SSBs have a high glycemic load, which causes insulin resistance, therefore increasing the risk for diabetes. In addition, because intake of sugar in liquid form is not very satiating, researchers are finding that calorie compensation for the energy consumed is less complete at subsequent meals than when ingesting solid food.[19]

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[10] http://www.ncbi.nlm.nih.gov/books/NBK53528/.
[11] Gaskin P. S., P. Lai, D. Guy, J. Knight, M. Jackson et al. 2012.
[12] Bremer A.A and R. H. Lustig. 2012
[13] Te Morenga L., S. Mallard, J. Mann. 2012.
[14] Jiménez-Aguilar A., M. Flores, T. Shama-Levy. 2006.
[15] Malik V. S et al. 2010.
[16] Fung T. T., V. Malik, K. M. Rexrode, J. E. Manson, W. C. Willett, F. B. Hu. 2009.
[17] Bremer A.A and R. H. Lustig. 2012
[18] Hector D., A. Rangan, J. Louie, V. M. Flood, T. Gill. 2009.
[19] Brownell K. D. 2009

Soft drink consumption has also other health implications other than weight gain, including dental caries and dental erosion, bone fractures, low bone density and osteoporosis, hypocalcaemia, disturbed sleep patterns, bedwetting and anxiety, headache, fatigue, decrease alertness, depressed mood and irritability, metabolic syndrome, high blood pressure, and possible adverse effects due to Benzene.[20]

Intake of SSBs during childhood increases the chances of overweight and obesity. A study conducted among schoolchildren over the course of 19 months found that for each additional serving of SSB consumed, both Body Mass Index (BMI) and frequency of obesity increased.[21] Intake of SSBs among children increases their chance of becoming obese by 60 percent and of predicting weight gain into adulthood. Among adolescents, research shows evidence for greater risk of cardiovascular disease and high blood pressure, dental caries and inadequate intake of critical nutrients like calcium, iron and vitamins due to intake of SSBs. Among adults, research suggests an association between SSB consumption and risk of weight gain and obesity, cardiovascular risk, higher risk of stroke, high blood pressure, type 2 diabetes, dental erosion, and pancreatic cancer.[22]

**Effect of Taxes on SSB Consumption and Health Outcomes**

The evidence of the impact of these taxes although growing is still limited. Evidence of an association between increased taxes and decreased SSB consumption can also be found in the majority of the scientific literature, especially where both obesity levels and soft drink consumption are high.[23,24] Studies by Andreyeva et al. (2010) find promising results on the effects of price increases on consumption. More specifically, in an analysis conducted by these researchers to estimate the effects of price changes on consumer demand of major commodity foods and drinks in the US, the highest price elasticity were found on soft drinks, juice, meat, and fruit, with low-income populations showing more sensitivity to price changes. The researchers estimate that a 10 percent tax on soft drinks could lead to an 8-10 percent decrease in the purchase of such beverages.[25] Brownell and Frieden refer to a Rudd Center report estimating a 7.8 percent consumption decrease for every 10 percent increase in the price of carbonated soft drinks and to an industry trade publication estimating a 7.8 percent sales drop with a 6.8 percent price increase.[26]

Some researchers also suggest a potential impact of such taxes on weight. The level of impact and the estimated weight or Body Mass Index (BMI)[27] loss varies from study to study. But most agree that significant effects on weight and BMI can only be achieved with equally significant tax increases. According to Fletcher and Frisvold one percentage point increase in soft drinks could affect BMI but only by 0.03 points, and that more significant population-level BMI changes would only be made possible with a higher tax increase.[28] Powell and Chriqui did not find significant associations between the existing state-level taxes in the US and adolescent weight outcomes. These taxes are low though, on average represented a 5.2 percent of sales prices. The researchers foresee a potential impact on weight with higher taxes.[29] Along similar lines, Clarke and Rayner, based on natural experiments, controlled trials, and modeling studies conclude that taxes can decrease consumption and improve public health outcomes significantly only if the tax is at least of 20 percent.[30]

And although most agree that taxes below a certain level do little to change overall population consumption and weight, some research suggests that even taxes as low as the sales price on sodas currently applied in US states can have an effect on subgroups of at-risk children especially when sodas are available in

[20] Hector D., A. Rangan, J. Louie, V. M. Flood, T. Gill. 2009.
[21] Ludwig D.S., K. E. Peterson, S. L. Gortmaker. 2001
[22] Friedman R. R and K. D Brownell. 2012. .
[23] Jou J and W.Techakehakij. 2012.
[24] Powell L. M et al. 2013.
[25] Andreyeva T., M. W. Long, K. D. Brownell. 2010.
[26] Brownell K and T. R. Frieden. 2009..
[27] An index commonly used to identify obesity, overweight, and underweight among adults. It is defined as weight in kilograms by the square of the height in meters.
[28] Fletcher J. M., D. Frisvold, N. Tefft N. 2010.
[29] Powell L. M., J. Chriqui, F. J. Chaloupka. 2009.
[30] Mytton O., D. Clarke, M. Rayner. 2012.

schools. A study in the US examined combined data from elementary school students in the US from the Early Childhood Longitudinal Study and from the Robert Wood Johnson Foundation on state-level grocery store soda taxes. The authors found that children that were heavier, in low-income families, African American or watched a lot of TV were most affected by the taxes especially when SSBs were available at school.[31]

Others agree with the previous conclusions and add that taxes can only reach their intended goals if coupled with effective nutrition education and substantial reductions in energy intake or energy expenditure. Lin and Smith hypothesized a 20 percent tax increase and estimated a significant reduction in calorie intake and obesity among adults and children (respectively 34 and 40 calories per day among adults and children with consequent weight reductions of 3.6 and 4.2 pounds in adults and children respectively and a reduction of obesity rate of 33.5 to 30.8 percent for adults and from 16.1 to 1.34 percent in children). However, they added, these reductions (which came with an estimated tax revenue of US$5.8 billion in 2007) could only be achieved with substantial reductions in energy intake and/or increases in energy expenditure as well as effective nutrition education especially among children.[32]

There are some disagreeing voices on the issue mostly coming from the soda industry. Consumer groups such as the Center for Consumer Freedom which are funded by and represent the interests of big soda companies, fast food restaurants and other for-profit companies,[33] or its Mexican counterpart *Central Ciudadano y Consumidor*,[34] contend that governments should not dictate on the population diets and rather leave that to free choice. They claim that research has no solid evidence that taxes will have but modest effects on purchasing behaviors and on weight gain. To support their statements, the groups often cite scientific articles showing little if no link between taxes and consumption and between taxes and weight gain.[35]

**International Experience in Imposing Taxes to SSBs and Foods of Low Nutritional Value**

Mexico is not the first country to have implemented a soda tax or a tax on high-calorie foods (Table 1). Whether or not the aim of the taxes is motivated primarily by health reasons or by the need to generate additional government revenue does not seem to necessarily impact the outcome of the tax as much as whether or not the general public is on board and aware of the health benefits of the taxes. In the case of Denmark for example, a "fat tax" aimed primarily to raise government revenues, with the acknowledgement of a potential decrease in fat and salt intake, was quickly lifted. The tax amounted to DKK 16 (US$2.84) per Kg and was imposed on butter, milk, cheese, pizza, meat, oil and processed foods containing more than 2.3 percent saturated fat.[36]

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[31] Sturm L. M et al. 2010.
[32] Lin B. H., T. A. Smith. 2010.
[33] Center for Consumer Freedom. 2013.
https://www.consumerfreedom.com/wp-content/uploads/2013/03/2013_SodaTaxReportFINAL.pdf
[34] Carlos Martinez Velazques. 2013.
[35] In one report, a study by Finkelstein et al. from the Duke University and the National University of Singapore was cited. The article concluded that taxes on SSBs would most likely have effects on purchasing behaviors, especially among the poorer households. Though the article admits that there is no certainty that taxes will have an impact on behaviors and that further research is warranted, the consumer group report interpreted such results as weak and not based on solid enough research[35]. Similar conclusions were made regarding other scientific articles (Pereira MA The possible role of sugar-sweetened beverages in obesity etiology: a review of the evidence. International Journal of Obesity Vol. 30 (2006):28-36; Conlantuoni F, Rojas C. Have soda tax effects changed over time? Scanner data comparison analyses. Selected Paper prepared for presentation at the Agricultural & Applied Economics Association's 2012 AAEA Annual Meeting, Seattle, Washington, August 12-14, 2012).
[36] BBC News. 2011. http://www.bbc.com/news/world-europe-15137948.

**Table 1: Examples of Taxes on Foods (as of October 2012)**

| Country | Year | Foods Taxed | Tax Rate |
|---|---|---|---|
| US | Various | Sugar-sweetened soft drinks in 23 states (SSSDs and other foods in 35 states) | 1-8% |
| Norway | 1981 | Sugar, chocolate, and sugary drinks | Variable |
| Samoa | 1984 | Soft drinks | 0.40 tala/L (£0.11; €0.14; $0.18) |
| French Polynesia | 2002 | Sweetened drinks, confectionery, and ice-cream | 60 francs/L (£0.41; €0.55; $0.66) for imported drinks |
| Fiji | 2006 | Soft drinks | 5% on imported drinks |
| Nauru | 2007 | Sugar, confectionery, carbonated drinks, cordial, and flavored milks | 30% import levy |
| Finland | 2011 | Soft drinks and confectionery | Soft drinks €0.075/L (£0.06; $0.10); confectionery €0.75/kg |
| Hungary | 2011 | Foods high in sugar, fat or salt, and sugary drinks | 10 forint (£0.03; €0.04; $0.05) per item |
| Denmark | 2011 | Products with more than 2.3% of saturated fat: meat, dairy products, animal fats, and oils | Kr16/kg (£1.76; €2.15; $2.84) of saturated fat |

Source: Landon 2012.

In general, industry tends to resist tax increases on products. In this case the industry did in fact resist it, especially when it came to taxing meat containing high levels of saturated fat. But the consequence the tax had on the public's purchasing behavior was ultimately what determined the outcome of the law. Due to the increase in prices, consumers began cross-border shopping, specifically to Germany and Sweden, to take advantage of lower prices. The industry and the country's Chamber of Commerce contended this was negatively affecting the country's labor market and overall economy. The government repealed the tax less than a year after it was put in place.

In the case of Hungary on the other hand, the public was overall on board with the tax. The government had imposed taxes on SSBs, energy drinks and high-calorie foods.[37] Although some complained that the true goal of the tax was to generate revenue, public awareness about healthy food had risen due to the tax. In a poll reported in a WHO report, 80 percent of respondents who were consuming less of the taxed products reported doing so due to the higher prices and 20 percent of those reported having become aware of the health implications of such products.[38] This made it easier for the government to maintain the taxes, even with the backlash of the industry. In fact, one of the other reasons why the tax was successful from a public health perspective was that the industry began reformulating its products, and either eliminating or substantially lessening the taxed elements contained in the products. The taxes are expected to raise revenues of EUR 70 million per year.

Although France's 2012 tax on sugary drinks and artificially flavored drinks (a 0.02 EURO tax on a 33cl can, almost 5 percent of the overall value) had the primary objective of increasing government revenue, the public was overall on board with the measure. The tax lead to a 5 percent drop in the carbonated soft drink

[37] In 2011 the government imposed a 5 HUF (US$0.01) per liter on sugar-sweetened beverages, HUF 250 (US$1.12) per liter on energy drinks, HUF 200 (US$0.89) per Kg on salty snacks and condiments and HUF 100 (US$0.44) per Kg. on confectionary, cookies, ice cream and chocolates.
[38] WHO. 2015.
http://www.euro.who.int/__data/assets/pdf_file/0008/273662/Using-price-policies-to-promote-healthier-diets.pdf.

market.[39] The tax was expected to generate revenues of EUR 280 million per year.[40] Similarly, in Finland, where a 2012 tax on confectionary products was imposed and excise taxes on soft drinks were raised from 4.5 cents to 7.5 cents per liter, the population was on board and reports suggest a decrease in sales and consumption of taxed products.[41]

In the US, 33 states have enacted taxes on soft drinks or passed laws stating that soft drinks are non-exempt from state taxes. According to researchers however, their impact on purchasing behavior and consumption in the general population are limited due to the fact that such taxes are very low (averaging 5.2 percent of sales prices). Moreover, the taxes do not have a primarily public health aim and their revenues are not earmarked for programs related to health.[42]

So far, only Hungary has conducted a formal evaluation of the outcomes of the tax and its findings are promising. The tax generated approximately EURO 61.5 million in 2013 and the population reduced consumption in concerned products and nutrients.

**Consumption Patterns of Foods and Beverages Subject to Taxation in Mexico**

Consumption of high-calorie drinks in Mexico is very high. Across all age groups, Mexico has one of the highest levels of consumption of high energy drinks in the world for ages 1 and over, with the most consumed being sodas (carbonated and non), juices (with or without added sugar), water and juices made from 100 percent fruit with added sugar, and whole milk. Alcohol is the 4$^{th}$ most consumed drink with high energy levels among men. [43]

Our own analysis based on household survey data from Mexico, found an increase in SSB consumption in Mexico in the last two decades (Figure 4). In 1989, 51 percent of the families in Mexico had purchased at least one SSB in a week. In 2012 the figure had increased by 20 percentage points. Most households consumed at least one soda during the reference week. This is likely an underestimation of total consumption since this household survey only provides detailed information of foods and beverages consumed in the household and not those consumed outside. These findings are in line with research conducted by Barquera et al., who synthesized dietary intake, income, and food expenditure data from the 1999 Mexican Nutrition Survey and 2006 Mexican Health and Nutrition Survey, and found an increase in the percentage of household soda consumption from 48 to 60 percent between 1989 and 2006. They also found that the percentage of overall daily energy intake from energy-containing beverages in Mexican adolescents and adults was 22.5 percent, higher than that in the US (21 percent).[44,45]

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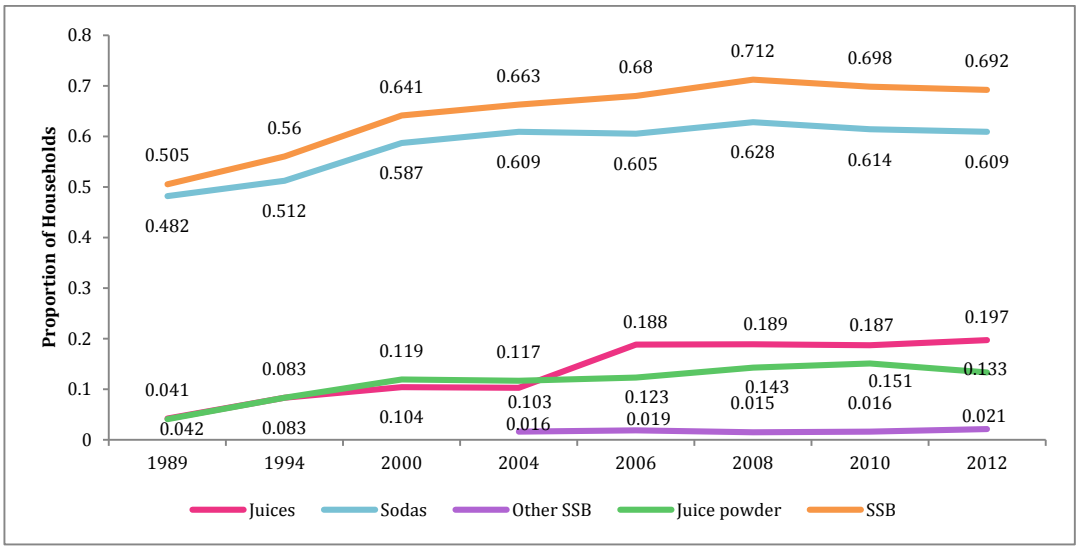
[39] Credit Suisse Research Institute. 2013. http://wphna.org/wp-content/uploads/2014/01/13-09_Credit_Suisse_Sugar_crossroads.pdf., 2016.
[40] OECD Obesity Update 2012. http://www.oecd.org/health/49716427.pdf
[41] OECD Obesity Update 2012. http://www.oecd.org/health/49716427.pdf
[42] Brownell K. D et al. 2009. N Engl J Med. 2009 Oct 15; 361(16): 1599–1605.
[43] Barquera S et al. 2008.
[44] The data used for the analysis only covered the household level consumption and not the consumption at the individual level, and it did not capture purchasing information beyond the household level. Despite these limitations, the authors found a definite increase in consumption of energy-containing beverages in the Mexican population over the past decades
[45] Barquera et al. 2008.

**Figure 4: Proportion of Households that Purchased one SSB during the Reference Week. Mexico, 1989-2012**




Source: Own elaboration using the National Survey on Household Incomes and Expenses (ENIGH) of the following years: 1989, 1994, 2000, 2004, 2006, 2008, 2010, and 2012.

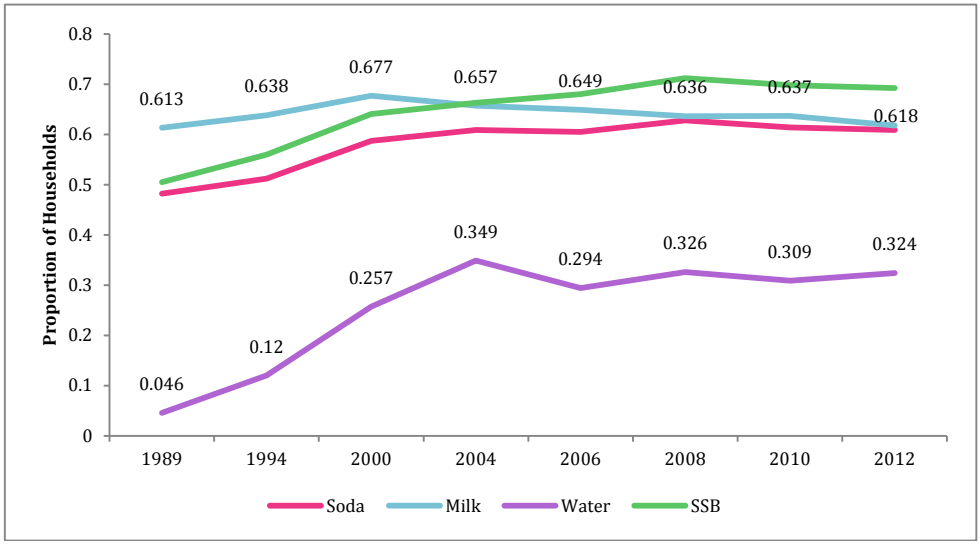
Other studies had similar findings. According to data from the Coca-Cola Company presented by the Mexican Health Secretariat, between 1991 and 2012 the per capita consumption of soft drinks in Mexico increased by 157 percent, from 68.8 liters per capita in 1991 to 176.3 liters per capita in 2012.[46]

Sodas are not the only SSB that Mexicans have increased consumption of (Figure 4). Mexican families have also increased intake of juices, energy drinks and fermented beverages. For example, in the early 90's less than 5 percent of families purchased juices. Over the next two decades that figure quadrupled. By 2012 almost 20 percent of households reportedly consumed at least one juice. All of this suggests that consumption of this type of product became more widespread among Mexican families.

The consumption of other beverages not subject to the tax and that could be substitutes for SSBs have followed different patterns. The consumption of bottled water increased rapidly from 1989 to the early 2000s. This consumption stalled later in the period observed. In contrast, the consumption of milk has been decreasing steadily since the late 1990s (Figure 5).

[46] National Strategy for the Prevention and Control of Overweight, Obesity and Diabetes. Health Secretariat. 2014.

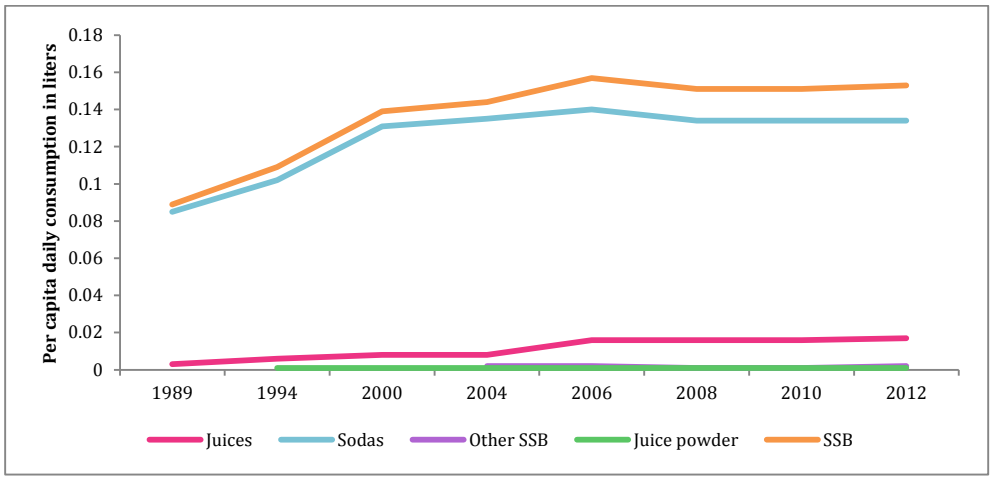
**Figure 5: Proportion of Households that Bought SSB and Possible Substitute Beverages During the Reference Week. Mexico, 1989-2012**




Source: Own elaboration using the National Survey on Household Incomes and Expenses (ENIGH) of the following years: 1989, 1994, 2000, 2004, 2006, 2008, 2010, and 2012.

Not only more families bought SSBs, but also the quantity consumed of these products increased slightly during the period of analysis. The following graph presents the daily per capita consumption of SSBs (Figure 6). Even when the increase is not particularly high for overall SSB consumption, the per capita growth in consumption is around 56 ml. During that period, consumption of sodas and juices also appear to have increased by 43 ml and 14 ml respectively.

**Figure 6: Per capita Daily Consumption of SSB. Mexico, 1989-2012**

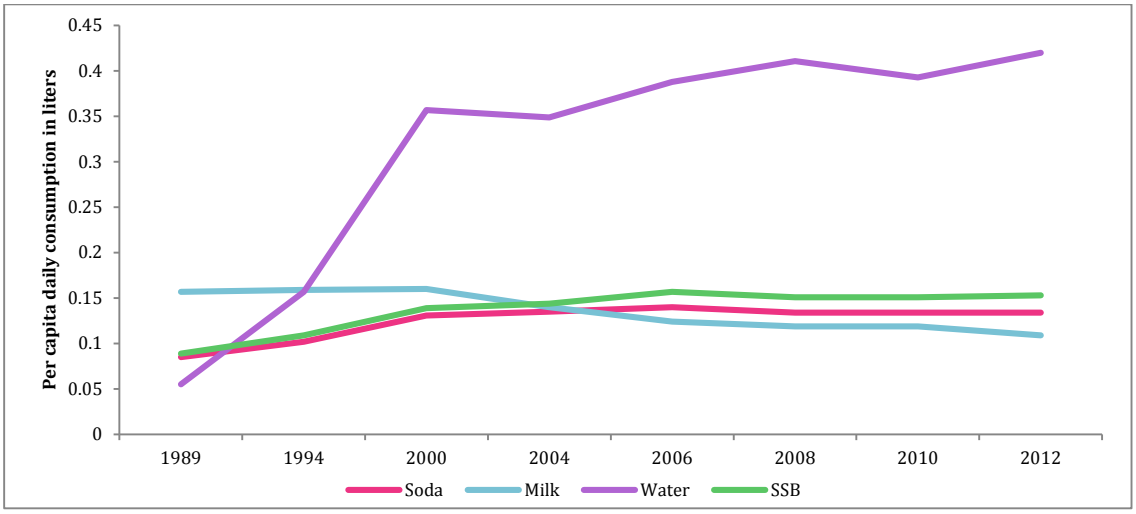



Source: Own elaboration using the National Survey on Household Incomes and Expenses (ENIGH) of the following years: 1989, 1994, 2000, 2004, 2006, 2008, 2010, and 2012.

There are large differences in the consumption of SSBs and that of goods that might appear as possible substitutes. Particularly interesting is the comparison between milk products and sodas. While per capita consumption of milk decreases between 1989 and 2012, the opposite trend was taking place for sodas. Since 2006, the consumption of sodas and in general SSBs has been higher than that of milk. Also interesting is to look at the consumption of bottled water. Even though the percentage of households buying

water is much smaller than those buying sodas or any other type of beverages, the total amount of liters of water consumed is much higher than that of any other type of beverage (Figure 7).

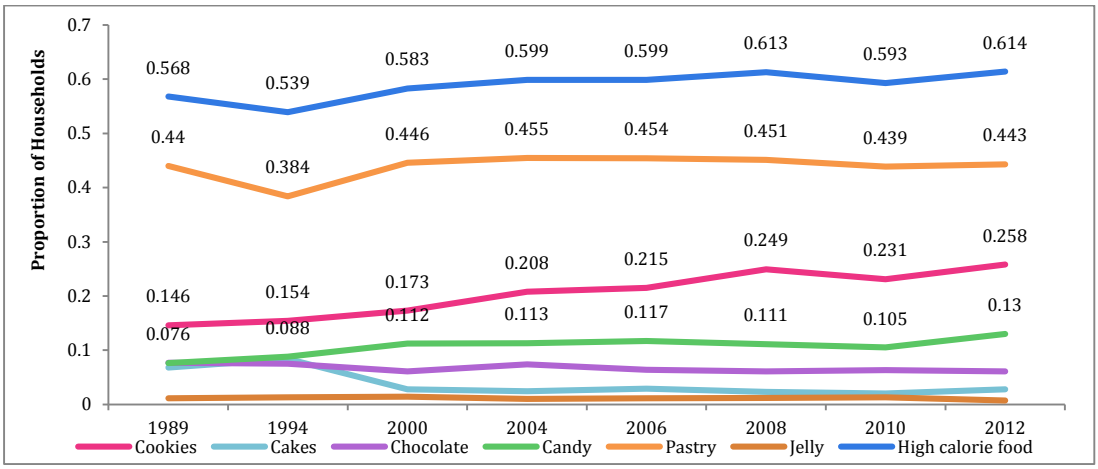
**Figure 7: Per capita Daily Consumption of SSB and Substitute Beverages. Mexico, 1989-2012**




Source: Own elaboration using the National Survey on Household Incomes and Expenses (ENIGH) of the following years: 1989, 1994, 2000, 2004, 2006, 2008, 2010, and 2012.

When examining the consumption of high-calorie foods during the same time period, the patterns observed are similar to those of SSBs. The data suggest that, though there was a sudden short-lived drop in consumption of such foods around 1994, there was an overall increase in consumption of high-calorie foods between 1989 and 2012, with cookies and candies experiencing the greatest increase (Figure 8).

**Figure 8: Proportion of Households that Bought High Calorie Goods During the Reference Week. Mexico, 1989-2012**




Source: Own elaboration using the National Survey on Household Incomes and Expenses (ENIGH) of the following years: 1989, 1994, 2000, 2004, 2006, 2008, 2010, and 2012.

**Consumption in Mexico Compared to the Rest of the World**

The levels of soda and SSB consumption seen in Mexico far exceed the average seen in other countries, especially countries at the same levels of economic development. Based on a systematic review and pooled analysis of dietary surveys, in 2010, global mean adult daily SSB consumption was estimated at 137 ml. SSB consumption however varies considerably by geographic location, gender, age and socioeconomic status and in general SSB consumption is higher in upper-middle income countries and lower-middle income countries, where the mean adult daily consumption is respectively 189 ml and 140 ml, than in high-income and low-income countries, where the mean adult daily consumption is respectively 121 and 83 ml.[47] Although consumption varies between regions, Mexico is a true outlier among middle-income countries. Mexico and Argentina, two middle-income countries, have unexpectedly high rates of soda consumption, compared to China or Malaysia, which, for example have similar GDP rates but experience significantly less soda consumption.[48]

According to a report developed by Credit Suisse Research Institute, world daily average consumption of sugar and HFCS per person is now 70 grams (17 teaspoons) per day. The countries consuming the most are the USA, Brazil, Argentina, Australia and Mexico, which are all at more than double the world average (40 teaspoons at day in the USA and 35 teaspoons a day in Mexico). In China on the other hand, consumption of HFCS is 7 teaspoons of sugar a day.[49]

[47] Singh G.M., R. Micha, S. Khatibzadeh, P. Shi, S. Lim, K. G. Andrews, et al. 2015.

[48] Marion Nestle. 2015.

[49] Credit Suisse Research Institute. T 2013. http://wphna.org/wp-content/uploads/2014/01/13-09_Credit_Suisse_Sugar_crossroads.pdf. Last accessed January 15, 2016.

# IV. THE TAX POLICY

**Political Process towards the Taxation of SSBs and Energy-dense Foods of Low Nutritional Value**

At the beginning of the administration of President Felipe Calderón (2006-2012), the Health Secretariat recognized overweight and obesity as one of the principal risk factors faced by the Mexican population and the health system.[50] Until then, civil society groups had been promoting discussions on the overweight and obesity epidemic in the country as well as the idea of a tax on SSBs. In 2006, the Mexican National Institute of Public Health published a breakthrough survey, the 2006 National Survey on Health and Nutrition, which revealed the burden of overweight and obesity in the country and the growing risk across socio-economic groups compared to previous years.[51]

Between 2007 and 2009, the Health Secretariat started to stimulate knowledge production about the problem, to discuss diet changes in school meals, to promote industry self-regulation on advertising and to coordinate prevention projects with other government units. In 2010, these initial efforts led to an initiative aimed to raise awareness and coordinate efforts among the public and private sectors to implement key actions to reduce the growth of the epidemic: the National Agreement on Food Health. As part of this initiative, two documents were produced: the Technical Bases of the National Agreement and, together with the Secretariat of Public Education, the General Guidelines for the Sale or Distribution of Food and Beverages in School Consumption Facilities in Basic Education Schools (Table 2). The activities of the National agreement were undertaken only through 2012, but the regulations regarding foods and beverages to be sold and distributed in schools is a legal document and represents one of the main achievements of the agreements.[52] This regulation has since been enshrined in the Constitution.

Besides awareness of the problem and policy coordination within the government, those initiatives further promoted knowledge and scientific production enriching policy-oriented discussions on obesity and overweight problems in the country. The initiatives were also useful to promote awareness and greater responsibility on the part of the industry.[53]

[50] As evidence of this concern, Bonilla- Chacin (2014) mentions the Sectoral Health Program 2007-2012 (PROSESA) and the National Health Program 2007-2012 (PRONASA). Both documents recognize the growing burden of non-communicable diseases in the Mexican population, such as Diabetes Mellitus and cerebrovascular ischemic heart diseases, which are related to poor diet, overweight, high cholesterol levels, hypertension, smoking and a sedentary life.
[51] In 2012, the new wave of the National Health Survey (ENSANUT) reveals a slower growth of the epidemic.
[52] Bonilla-Chacin, ed., 2014.
[53] Idem.

**Table 2: Initiatives to Reduce Overweight and Obesity Before 2013**

| Initiative | Date | Goals | Priority objectives/actions | Actors |
|---|---|---|---|---|
| **National Agreement on Food Health: Strategy against Overweight and Obesity** | January 2010 | Reverse overweight and obesity growth rate among those less than 5 years old; stop the growth among 5 to 19 years old; and slow the growth among adult population | i) Promote physical activity; ii) increase availability of drinking water; iii) decrease consumption of sugars and fats in drinks; iv) increase intake of fruits and vegetables; v) improve nutrition labeling; vi) promote breast-feeding until six months of age; vii) decrease the consumption of sugar and other caloric sweeteners added to food; viii) provide guidance on portion sizes; ix and x) reduce daily intake of saturate fats and sodium. | Federal agencies; the industry; and social organizations. Multi sectorial National Forum for the Prevention of Overweight and Obesity |
| **Technical Bases of the National Agreement on Food Health** | February 2010 | States the vision, the goals for 2012 and its objectives in a much more precise manner than the National Agreement | Describe the conceptual framework; provides an extensive diagnosis of the problems; proposed 117 activities with 249 actions, designating responsibilities by Secretariat and entity | Health Secretariat (SS) and the National Institute for Public Health (INSP) prepared "Bases for a Sate Policy to Prevent Obesity" and background materials for the Technical Bases |
| **General Guidelines for the Sale or Distribution of Food and Beverages in School Consumption Facilities in Basic Education Schools** | August 2010 to be impleme nted starting in January 2011 | Ensure that foods which are prepared and sold at schools contribute to a healthy diet | i) Establish the nutrient criteria for food and beverages recommended for consumption and those that should not be distributed; ii) create a School Food Facility Committee to monitor the preparation, management, consumption and sale of food and beverages within the schools | Secretariat agreement between the Secretariat of Health (SS) and the Secretariat of Public Education (SEP). Compulsory official regulation for all public and private basic schools |

Source: Bonilla-Chacin ed. (2014)

The initiatives described in Table 2 were a good foundation to move the process forward towards national level actions to improve nutrition and health in the population. However, the initiatives lacked the social mobilization and political support needed to translate into laws and concrete programs.

In December of 2012, Enrique Peña Nieto became President of Mexico promising major fiscal reforms that would generate new tax revenues. The day after he took power, the President received backing from the country's three major political parties.[54] Those parties had formed a pact called *Pacto Por México*, the objective of which was to support the President in passing widespread reforms.[55] Among the 95 initiatives agreed upon by the pact was a tax on SSBs. Only days after the President took power, a major proposal created by civil society groups and academic institutions was presented by Sen. Marcela Torres Peimbert, who was sensitive to these issues, thanks to her previous work in the public health sector. The proposal included a 20 percent ad valorem tax on sodas. The proposal was ultimately excluded from the initial 2013 Budget Reform Draft. But in May of 2013, the national development plan (*Plan Nacional de Desarrollo*) was presented to Congress and in it was cited a book published by representatives of academic medical institutions. The book, Obesity in Mexico: recommendations for a Government policy (*Obesidad en México: recomendaciones para una política de Estado*) highlighted 2004 data indicating that 75 percent of all deaths

[54] The Institutional Revolutionary Party (PRI), the National Action Party (PAN), and the Party of the Democratic Revolution (PRD).
[55] What is the Pacto por México? Council of the Americas. http://www.as-coa.org/articles/explainer-what-pacto-por-m%C3%A9xico

in the country were due to non-infectious chronic diseases related to nutrition problems, with major risk factors being obesity and high sugar intake. Citing the 2012 national health survey (ENSANUT 2012), the book showed how the epidemic was growing in the country, especially among children and the poor. It called for government regulation, legislation, and fiscal measures. It also called for the creation of social norms around improved nutrition and increased physical activity to be achieved through awareness-raising campaigns and circulation of sound, scientifically based information.[56]

During 2013, the tax increase on sugar-sweetened beverages produced an active discussion on forums and events with the participation of members of the legislative, civil society organizations (such as ContraPESO and *Alianza por La Salud Alimentaria*), the National Institute of Public Health and multilateral organizations such as the WHO and its regional counterpart PAHO. In September of 2013, President Peña Nieto presented the annual Budget inclusive of a 1-peso-per-liter tax on each liter of SSBs with the specific goal of decreasing soaring levels of obesity and diabetes, especially among children. A proposal to double that tax rate to 2 pesos for each SSB liter was discussed in plenary sessions but ultimately rejected. Simultaneously, Senate members from the Partido de la Revolución, PRD, proposed an additional 20 percent tax on energy dense foods.

Ultimately, the Senate approved an 8 percent ad valorem tax on high-calorie foods. It excluded some unprocessed foods and it included different kinds of snack, chocolates, ice cream, cookies, sugary cereals, etc. Both taxes were approved on October 29 and came into effect on January 1, 2014.

The forces at play

The passage of the taxes in other words was the result of two parallel forces: the government need for increased tax revenues and the need to put a stop to the alarming numbers of the obesity epidemic which was threatening to weaken the country's economic and social wellbeing.

As with any major political and economic decision, a lot of factors were involved in the successful passage of the law. Several actors worked both alone and in partnerships to overcome major obstacles encountered along the way, the most important one being the opposition created by the soda industry and its political supporters.

The actors involved

The Health Secretariat and the National Institute of Public Health were not the only institutions that advocated for the fiscal policy to fight against obesity. Civil society organizations and medical academic institutions were the first to raise awareness and circulate knowledge about the public health emergency that the country was facing. Groups like El Poder del Consumidor, Fundación Mídete, COA Nutrición, REDIM, and others groups such as small farmers and water protection agencies created an alliance to demand a government policy to fight the obesity epidemic and malnutrition in Mexico.[57] The *Alianza por la Salud Alimentaria* was active in many ways, including drafting laws and proposals, raising awareness and circulating educational information, lobbying representatives from the legislative and executive bodies and delivering media campaigns to create public support. One of its trademarks was an ad depicting two young children being offered a soda drink entitled "would you offer them 12 spoons full of sugar?" (*Les darías 12 cucharadas de azúcar?*). Specific mention needs to be given to the special nature of the Alliance. As mentioned earlier, it brought together a wide range of organizations representing many different interests, from children's rights to water rights, from development issues to consumer rights, and more. But they all shared the common goal of improving nutrition in Mexico. Even more importantly, though their initial agenda comprised of several items, early on they prioritized and focused on their first battle: to advocate for government taxes on sodas. This decision was reached thanks to a political calculation made by politically savvy groups of the Alliance who had extensive advocacy and lobbying experience and who understood the specific political climate in Mexico and the possibilities it offered. Mexico's upcoming general elections

[56] Obesidad en México: recomendaciones para una política de Estado. Síntesis Ejecutiva del Libro. http://www.oda-alc.org/documentos/1365120227.pdf..
[57] Alianzasalud.org

represented a window of opportunity for the group and its advances, especially since the incoming party had among its objective to lead a major tax overhaul.

Once the priority had been established, the Alliance began working heavily on two main fronts in order to make change: initiating a media campaign and lobbying the country's key decision makers.

The group posted ads in newspapers and magazines. Messages were aired on the radio and TV and YouTube videos were blasted. These were all mainly aimed at educating the public on the negative health consequences caused by SSBs. The Alliance's PR efforts led to press conferences, newspaper articles and the publication of opinion pieces that added strength to the ongoing educational and media efforts. They organized public protests, in turn gaining more news coverage, and, together with lawyers and fiscal experts, drafted proposals ultimately presented to Congress. Simultaneously, and counting on the roster of connections that many of the Alliance's organizations brought to the table, members met with decision makers, wrote letters to legislators and conducted outreach events with the intent of persuading legislators to support the tax.

Both the Alliance and the legislators who ultimately managed to pass the tax reforms gained credibility also thanks to the vast scientific evidence that had been accumulating for years, both internationally and domestically, on the health effects of SSB consumption and on the positive financial and health benefits of a soda tax.

Public Institutes such as the *Instituto Nacional de Salud Pública* – INSP and the *Instituto Nacional de Ciencias Médicas* were crucial in providing the academic grounding for groups and politicians to make the case for a national strategy and to push for legislations and fiscal measures. As mentioned earlier a multidisciplinary group focused on Obesity and headed by INSP authored a book, which influenced the congressional discussions leading up to the passage of the soda tax and snack laws in October of 2013.

The Bloomberg Philanthropies also contributed to this effort. The foundation provided $16.5 million over the course of three years "to support public health policies aimed at reducing obesity in Mexico."[58] The foundation provided support to the leader of the *Alianza por La Salud Alimentaria*, formerly *El Poder*, who had played a crucial role in pushing the agenda forward on the soda tax and previously, in limiting junk food in schools and junk food advertising on television.[59]

International organizations such as the World Health Organization and the Pan American Health Organization also played crucial roles in the process, participating in and organizing national and international forums and discussions, and helping craft effective messages against opposing arguments.[60]

But without the backing of specific legislators and senators, the Health Secretariat as well as the President of the country, the passage of the laws and the development of messages would not have been possible. As mentioned earlier, one of the legislators that took on the responsibility of moving the discussion ahead was Sen. Marcela Torres Peimbert who presented the initial proposal of the soda tax to Congress but who also organized fora and represented the interests of civil society groups in the legislative bodies.

<u>Opponents</u>

Unsurprisingly these groups faced strong opposition. The opposition came from the beverage and food industry, sugar companies, bottling companies, and some allies in the executive and legislative branches of government, as well as lobbyists and civil society organizations.

Just like the promoters, these groups organized themselves, developing alliances (the National Association of Small Merchants – ANPEC and Mexico's soft drink makers' association, ANPRAC) and crafting clever

[58] Supporting Strong Policies to Halt Rising Rates of Obesity. Bloomberg Philanthropies. http://www.bloomberg.org/program/public-health/obesity-prevention/#overview.
[59] Tina Rosenberg. The Guardian. 2015.
[60] Elizabeth Donaldson. 2015.

media campaigns ("Share a Coke" read one industry ad). Their major arguments included the lack of solid scientific evidence linking SSBs to overweight and diabetes and promoting the value of freedom of consumers. Some companies claimed that by imposing such fiscal measures the government was harming their businesses and consequently the overall economy.[61,62] The companies also created so-called "front groups" like the *Central Ciudadano y Consumidor* which circulated information putting forth the companies' arguments and debunking the scientific literature's findings on the health consequences of soda consumption as well as on the impacts of soda taxes on purchasing and consumption behavior. The efforts of the industry were heard again in the Fall of 2015 when companies like FEMSA, Coca-cola's major bottling company in Mexico, and ANPRAC, Mexico's soda industry lobby, engaged in conversations with members of the (Institutional Revolutionary Party) PRI, the majority party, to reduce the SSB tax to 5 percent for drinks with 5 grams of added sugar per 100ml. The companies repeated arguments used during debates that preceded the implementation of the law, mainly that the tax was costing jobs and was harming the country's economy. This time however, ANPRAC, had come out with numbers claiming that SSB sales had only decreased by 1.9 percent and Mexicans were consuming only 6 calories less a day due to the soda tax. Moreover, they claimed that the tax negatively impacted households, especially the poorer ones, because purchasing power for the basic food basket fell by 3 percent in 2014, and this was reportedly due to the increase in prices on drinks.[63]

In October of 2015, the efforts of these groups led the Mexican Chamber of Deputies to vote for a cut in the tax to SSBs. This produced an outcry from the very same organizations and institutions that had led the original fight. The Nutritional Health Alliance and ContraPESO along with other national and international groups mobilized a second wave of media campaigns, including a newspaper ad asking lawmakers to pick sides between the public health interest and the soda industry interests. At this point the groups could count on scientific evidence that the tax was in fact working. The *Instituto Nacional de Salud Pública* and the University of North Carolina had come out with their results (later published in BMJ) that the purchase of taxed beverages had decreased by 6 percent and that the greatest decreases had been experienced among the households of low socioeconomic status.[64] The Senate ultimately overturned the amendment.

**Designing an Effective Tax**

The key public health rationale for using taxes on health-related commodities lies in: "their ability to change people's consumption behaviors."[65] However, in order to produce that behavior change, a tax on health-related commodities should increase relative prices of targeted products (that is, less healthy foods, tobacco, alcohol), and then lead to an effective consumption reduction; otherwise there cannot be an improvement in health outcomes.[66] It is possible to imagine a logical sequence for successful fiscal policies on health related commodities, going from policy instruments to health outcomes, as shown in Table 3.

[61] The Guardian, October 15, 2015. http://www.theguardian.com/global-development/2015/oct/19/mexico-soda-tax-cut-pop-fizzy-drinks

[62] Eric Martin and Nacha Cattan. 2013. http://www.bloomberg.com/news/articles/2013-10-29/mexico-tackles-obesity-epidemic-with-tax-on-junk-food.

[63] ANPRAC< Industria Refresquera Mexicana. 2016. http://anprac.org.mx/el-impuesto-a-las-bebidas-bajo-el-consumo-de-calorias/

[64] Colchero et al. 2016.

[65] Sassi et al. 2013.

[66] It is also possible to use public subsidies instead of taxes to change relative prices, for example using them to reduce the price of healthier foods and in that way to increase relative prices of less healthy foods. In the literature, it is recognized that sometimes it is necessary to provide incentives for the supply of more healthy foods (so the reason of subsidies). However, the implementation costs of tax and subsidy policies normally are not equivalent.

**Table 3: Sequence for Successful Fiscal Policies on Health-related Commodities**

| |
|---|
| **Taxes/Public subsidies => increase relative prices of unhealthy foods => reduce consumption and avoid substitution to equally harmful products => Positive health outcomes** |

This section provides a detailed explanation of the chain mechanism by which a fiscal policy, mainly a tax policy, can affect health outcomes.[67] It is focused on three of the key links presented in Table 3, which are relevant to analyze the Mexican case: (i) how taxes/subsidies could increase relative prices of less healthy or selected-unhealthy foods; (ii) how relative price changes could alter consumption behavior of unhealthy commodities; and (iii) how fiscal-policy design and implementation could avoid consumption substitution from taxed to equally harmful but untaxed products. There is a fourth important link in this literature related to how lower consumption produces better health outcomes, in terms of lower Body Mass Index. These possible outcomes were discussed in a previous section that detailed important evidence in the US regarding the case of sweetened beverages and reduce BMI among the most vulnerable groups.

While any level of consumption of tobacco products is considered harmful, in the case of alcohol and food consumption, the harmful effects derive mostly from excessive or inappropriate consumption. Taxes obviously hit all consumers, albeit to different degrees. As a result, it is more difficult to define an appropriate tax rate for health purposes on the latter type of products.

To produce an effect on consumption, tax-rate increases on health-related commodities must raise their consumer prices. If tax-rate increases are completely absorbed in the supply chain, they end up reducing profits, consumer prices are not altered, and consumer demand remains unaffected. The degree to which tax rate modifications translate into changes in consumer prices is often called “tax pass-through”.

The literature has focused more on non-alcoholic beverages, because of increasing consumption and policy interest. There are a few experimental or empirical analyses of taxes on non-alcoholic beverages and their impacts on prices. Bonnet and Réquillart (2012) simulate the soft drink industry behavior in France and conclude that the assumption of passive pricing by this industry leads to a poor estimate of the impact of an upstream cost shock, such as taxes. The authors assume that competition in the industry is horizontal (between producers on the one hand, and between retailers on the other), as well as vertical (between producers and retailers), and conclude that strategic pricing and the relationship between industry and retailers are likely to lead to over pass the tax amount. They expect a different behavior according to the type of tax: an over-shift of 7 to 33 percent for a specific duty, while an equivalent ad valorem tax would be under-shifted by 10 to 40 percent (Bonnet and Réquillart, 2012). Bergman and Hansen (2013) evaluate the impact of various excise tax variations on alcoholic and non-alcoholic beverage prices in Denmark. Based on the analysis of micro price data used by the office of statistics in Denmark to compute the Danish Consumer Price Index, they come to the conclusion that the two increases in the soft drink tax that occurred in 1998 and 2001 were over-shifted to consumer prices.

Usually food and beverage manufacturers and retailers pass taxes onto consumers in excess of the amount of the tax.[68] However, differences in tax pass–through across different types of retailers have been shown after the introduction of a fat tax in Denmark.[69] A study after the introduction of the French soda tax in January 2012, focusing on purchases of beverages ordered on the Internet, estimated that consumer prices increased gradually. By May 2012, the tax was more than fully shifted to soda prices while about 85 percent

[67] The literature about public subsidies on healthy food is less abundant and it will not be considered here.
[68] Andreyeva et al., 2010.
[69] Jensen and Smed, 2013.

and 60 percent of the tax was passed through to consumers for flavored waters and fruit drinks respectively, but with a high degree of heterogeneity across retailers and brands.[70]

Relative price changes and consumption behavior of unhealthy foods

Once the price of the taxed commodities increases, the impact on their consumption is determined by the price elasticity of the demand for such commodities, that is, by the responsiveness of consumers to price changes. The elasticity of the demand for a commodity determines whether consumers will increase the proportion of their own income they spend on that particular form of consumption (inelastic demand), or decrease it (elastic demand), when a tax increases the price of that commodity.

Besides the change in demand of the taxed commodity, it is also important to consider the effects on the consumption of complementary goods (whose demand changes in the same direction of the analyzed product) and substitute goods (whose demand changes in the opposite direction). With an inelastic demand, tax and price increases on a commodity will likely displace other forms of complementary consumption, because the income available for other forms of consumption will shrink. Depending on the nature of the consumption that is displaced, this displacement effect may strengthen or weaken the ability of the tax to achieve its goals. If the tax is aimed at reducing the consumption of potentially unhealthy commodities whose demand is inelastic, and consumers end up decreasing their consumption of healthier commodities, as well as their consumption of the taxed commodities, the purpose of the tax could be largely defeated. A further problem may arise when a close substitute for the taxed good is available, leading to an elastic demand. Consumers may reduce, even substantially, their consumption of the taxed commodity and replace this with an increased consumption of the substitute commodity. If the latter has similarly negative consequences on consumers' health as the former, the purpose of the tax is again largely defeated.

The demand for most health-related commodities that are currently taxed or have been considered for possible taxation tends to be inelastic. However, it is easier for people to find substitutes for certain commodities (for example, specific types of food) than for others (such as cigarettes), therefore, the overall impact of a tax will partly depend on whether the tax is suitably designed to cover possible substitute commodities.

Studies undertaken in different countries provide a range of elasticity estimates for foods and non-alcoholic beverages, partly dependent on the definitions and the degrees of aggregation of food categories.

Staple foods tend to have a less elastic demand than foods that are easier to substitute. The demand for most foods is inelastic, and more so in higher income countries, as shown in Andreyeva et al. (2010). However, if people are aware that a product was taxed for public health reasons, they may be more likely to change their consumption.[71]

Sugar-sweetened beverages, which have recently been viewed as a possible target of taxation (for example, as in France and Mexico), have elasticity estimates in a relatively broad range, from inelastic to elastic, as shown in Table 4. The potential for substitution across beverage categories is high; therefore elasticity estimates may depend on the aggregation of categories for which the effects of price changes are examined.[72] Low-income consumers and children are the most price-sensitive.[73] The impact of price changes is stronger for consumers in poorer socioeconomic conditions, who have a more elastic demand for a range of food products.[74]

[70] Berardi et al. 2012.
[71] Thow et al., 2010.
[72] Smith et al. 2010.
[73] Faulkner et al. 2011.
[74] Green et al. 2013.

**Table 4: Own Price Elasticity of the Demand for Selected Foods and Non-alcoholic Beverages**

| Food/Beverage group | Systematic Review | Meta-analyses | | |
|---|---|---|---|---|
| | USA[1,2] | Low income countries[3] | Middle Income countries[3] | High Income countries[3] |
| Fats/oils | -0.48 | -0.6 | -0.54 | -0.42 |
| | (-0.14 to -1.0)[1] | (-0.65 to -0.54) | (-0.60 to -0.47) | (-0.48 to -0.35) |
| Cereals | - | -0.61 | -0.55 | -0.43 |
| | | (-0.66 to -0.56) | (-0.61 to -0.49) | (-0.48 to -0.36) |
| Sweets/sugar | -0.34 | | | |
| | (-0.05 to -1.0)[1] | | | |
| SSBs, sweets& confectionery | | -0.74 | -0.68 | -0.56 |
| | | (-0.82 to -0.65) | (-0.77 to -0.59) | (-0.65 to -0.48) |
| Soft Drinks | -0.79 | - | - | - |
| | (-0.13 to -3.18) [1,a] | | | |
| | -0.86 | | | |
| | (-0.41 to -1.86) [2,b] | | | |
| Isotonic, sport drink | -2.44 | - | - | - |
| | (-1.01 to -3.87)[2] | | | |
| Juice | -0.76 | - | - | - |
| | (-0.33 to -1.77)[1] | | | |
| Milk | -0.59 | - | - | - |
| | (-0.02 to -1.68)[1] | | | |

Source: Sassi et al. (2013) Table 1

[1]Andreyeva et al. 2010.

[2] Powell et al. 2013.

[3] Green et al. 2013.

[a] Different definitions of soft drinks are used in different studies. Fruit juices are not included

[b] Soft drinks include both regular and diet versions of soft drinks.

Existent tobacco products can be defined with a high degree of precision and almost the same can be done with the different segment of the alcohol industry – beer, wine, liquors, etc. Consequently, demand elasticities can be estimated with a fair degree of precision and have shown convergence in cross-country estimations. However, sugary drink and food definitions can vary according to data availability and market characteristics. The international literature points to the fact that elasticity magnitudes depend on definition and aggregation of the food and the group studied. As a result, a large interval of elasticity magnitudes has been observed (column 1, Table 4).

Fuentes Castro and Zamudio Carrillo (2014) reviewed demand elasticity estimations of soft drinks, industrialized juice and bottled water in Mexico. Using the National Households Income and Expenditures Surveys (ENIGH), they showed that elasticity magnitudes depend on the product definition: the broader the aggregation, the higher the elasticity magnitude (more elastic). They showed that soft drinks could become inelastic if only some segments of the markets were considered.

<u>Tax design and tax implementation to avoid substitution towards unhealthy foods</u>

Tax policies and reforms with a public health purpose should cover all potential substitutes of the products taxed. Within this context, the tax reform implemented in Mexico is appropriate as it covers all possible SSBs, and a broad group of unhealthy foods are covered under the 275-calories-per-100-grams

classification. However, using excise taxes for a broad set of products with many producers requires significant implementation and monitoring efforts (PRODECON, 2013).

In the case of SSBs, the most important relationship is between regular and low-calorie soft drinks. If regular soft drinks have a high price differential due to the tax reform, consumers either increase their demand for low-calorie drinks (substitute) or, alternatively, reduce their intake of low-calories drinks. According to Sassi et al. (2013) the empirical evidence is not conclusive about the nature of this relationship, although the few existent empirical studies show that they can be complementary goods. In France for example, substitution towards low-calorie beverages took place (Bonnet and Requillart, 2012). There is evidence globally of a growing market of low-calorie drinks due to consumers' heightened concerns about overweight and obesity. This could indicate that low-calorie drinks are indeed substitutes of SSBs.

Mexico's tax reform covers a whole range of sugar-sweetened beverages including possible substitutes to sodas. This is an important element of the tax because other soda tax experiences have shown consumers tend to substitute sodas with other drinks containing added sugars, leaving calorie consumption rates among the population unchanged. Limited evidence indicates that the current practice in the United States leads to a moderate reduction in soft drink consumption in children and adolescents, but the reduction of soda consumption is offset by increases in consumption of other high-calorie drinks (Fletcher et al., 2010). However, a more recent study on the impact of a tax on SSBs in the United States concluded that no significant substitutions to other sugary foods and beverages would take place, while a parallel reduction in the consumption of complementary caloric products would further reduce energy intake.[75]

Less is known about the substitution process that takes place after a tax on low nutritional-high calorie-foods is imposed. The Mexican rate -8 percent of the pre-tax price- is low and most of those products do not pay VAT rates. During the first year of the tax reform, foods considered as necessities, such as wheat and corn tortilla, were exempted from the excise tax. Also, small establishments were given additional time to adjust to the new taxes (SHCP, 2014).

The experience from liquor taxation, where the possibility of homemade production of certain types of liquors is significant, indicates that whenever possible people tend to substitute manufactured low nutritional-high-calorie foods for homemade foods. Substitution possibilities should be analyzed case-by-case, but changes in the sales of sugar and fats should be observed as an indicator of homemade preparation of high-calorie foods.

**A Closer Look into the Mexican Taxes on SSBs and High-energy Foods**

Given the wide range of SSBs in Mexico, the 2013 Reform of the IEPS law sought to levy the entire spectrum of SSBs to avoid the pitfalls of increasing consumption of substitute SSBs not included in the tax. The text of the law listed the different types of beverages covered by the tax. The common thread throughout the list of products is the presence of added sugar:

i. Any flavored non-alcoholic beverages, concentrates, powders, syrups, essences or flavored extracts, which can be diluted to obtain flavored non-alcoholic beverages and syrups or concentrates for flavored non-alcoholic beverages as long as those goods contain added sugars.
ii. In the case of concentrates, powders, syrups, essences or flavored extracts, the tax rate is calculated considering the number of liters of flavored non-alcoholic beverages that is possible to produce with those elements, according to producer technical specifications.
iii. The energy drinks with added sugars are taxed with the IEPS of sugar-sweetened drinks on top of the 25 percent IEPS rate for energy drinks[76].

The following sugar-sweetened beverages were exempted from the tax:

i. Those registered as medicines (for example, cough syrups)

[75] Finkelstein et al., 2013.
[76] In order to avoid interpretation challenges, the 2013 reform of the IEPS Law establishes a definition of flavored non-alcoholic beverages, concentrates, powders, syrups, essence, flavored extracts and energetic drinks.

ii. Oral rehydration solutions
iii. Milk in any presentation
iv. Beverages prepared in restaurants and other places such as bars and cinemas (as these cases are considered as a service provision and not a sale and thus are not regulated by the IEPS).

In the case of non-basic food items of more than 275 calories per 100 grams, considered as low-nutritional-high-calorie foods, the law listed a set of non-basic food products:

i. Snacks
ii. Candy store products
iii. Chocolate and other cocoa derivative products
iv. Crème caramel and pudding
v. Fruit and vegetable sweets
vi. Peanut and hazelnut cream
vii. Caramel
viii. Sugary cereals
ix. Ice creams

The law delegated the Tax Administration Service to establish those high-density foods considered basic foods. So, the following list of basic and high density foods was created:

i. Wheat-based products:
   a. Wheat flour tortilla, including whole wheat
   b. Non-sweet breads: bolillo, telera, baguette, chapata, birote and similar, white and whole grain, including pan de caja
   c. Foods based on wheat cereals without added sugars, including whole wheat
ii. Corn-based products:
   d. Corn tortilla, even when toasted
   e. Foods based on corn cereals without added sugars
iii. Other cereal-based products:
   f. Foods that are cereal based for babies and young children.
   g. Foods that are cereal based without sugars, including whole grains.
   h. Non-sweet breads from other cereals, whole grain or not, including pan de caja.

The 2013 reform of the IEPS law established the categories of high-density non-basic foods (> 275 calories per 100 grams) and meant to cover the main products consumed by the Mexican population. However, during 2014, the Tax Administration Service needed to produce additional specifications for certain products defined in the law, such as snacks, chocolate and cocoa derivative products, raw cereal preparations. In May 2015, the Tax Administration Service established that the application of the tax rate would consider the calories defined in the product labeling in conformity with la Norma Oficial Mexicana (NOM-061-SCFI/SSA 1-2010).

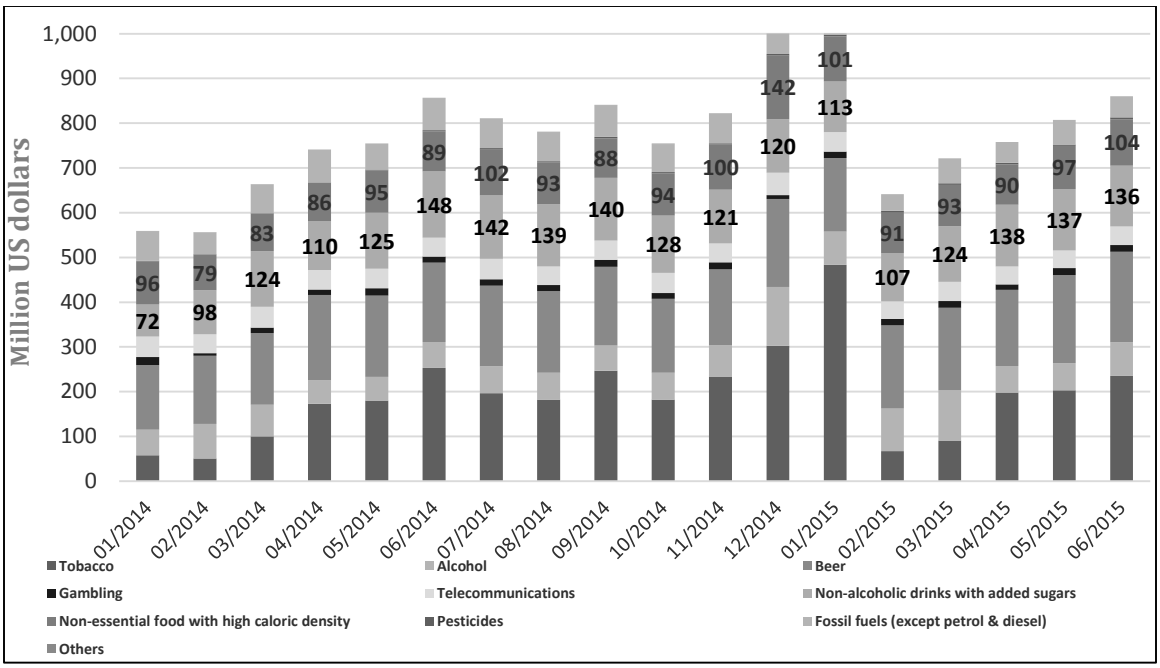
The Mexican tax reform aimed to cover all possible substitutes of its aimed objectives (sugar beverages and low nutritional-high-calorie non basic foods). However, differently from taxes on SSBs, taxes on low nutritional-high-calorie foods are more difficult to enforce and administer. First, there is artisanal and homemade production of many types of those industrialized products covered by taxation. To reduce the homemade and artisanal production, the government taxes corn and wheat flour, nixtamal and corn dough. Second, given the vast set of products, even without ready substitutes it would be difficult to tax and control each one of them. The question is to focus on the products that are most relevant in terms of high-calorie consumption.

# V. AGGREGATE IMPACT OF THE TAXES AND MONITORING FRAMEWORK OF THIS IMPACT

**Impact of the Taxes on Revenue Collection**

The two taxes were part not only of the National Strategy for the Prevention and Control of Overweight, Obesity and Diabetes but they were also part of a comprehensive fiscal reform. As such, one of the main objectives of the reform was precisely to increase government revenue. Figure 9 shows the revenue collected from the two new taxes on SSBs and calorie-dense foods of low nutritional value. As can be observed in the graph, revenues from the tax on SSBs were greater than the revenues collected from the tax on high-calorie foods.

**Figure 9: Seasonal Comparison of IEPS Revenue between 2014 and 2015**




*Excludes IEPS revenue on petrol and diesel: Total revenue: USD$9.154 billion)
*Average exchange rate: MXP$13.31 – USD$1.00.*
*Source:* Health Secretariat – Economic Analysis Unit using data from the Secretary of Finance and Public Credit. Opportune Statistics of Public Finance. 2014. INEGI. CPI and Banco de Mexico for Exchange rates.

There is currently a debate on whether the revenue collected from these taxes should be earmarked for health and particularly for activities aimed at the prevention and control of overweight, obesity and diabetes. At the moment, the revenue collected from these taxes is not set aside for any particular type of expenditure. Box 2 below provides an overview of international examples in earmarking "sin taxes" for health and some of the arguments in favor and against this.

**Box 2: Earmarking Revenues from "Sin Taxes" for Health**

Taxes on products known to be harmful to health such as alcohol, tobacco, and also SSBs and foods of low nutritional value (sometimes known as "sin taxes") are widely applied and sometimes are earmarked, at least in part, for health. While sin taxes do not raise significant resources to fund general health coverage, earmarked taxes overall have been successfully used to partially or totally finance different types of health expenditures such as:

i) Health promotion funds (e.g. Australia, Thailand, Taiwan, and Mongolia) and specific health activities such as tobacco control (e.g. Panama, Taiwan, Laos, and Vietnam) or alcohol reduction programs (e.g. New Zealand);
ii) Treatment of certain diseases or specific health expenditures such as cancer (e.g. Nepal) or AIDS treatment (e.g. Zambia); and
iii) General health coverage extension for either health insurance based systems (e.g. France, Taiwan, Ghana, and Gabon), tax financed systems (e.g. Guatemala, Djibouti, Mongolia, and Qatar), or the poor (e.g. Philippines and Chile).

There is considerable debate about whether hypothecation of tax revenues for health is desirable or not. In general, ministries of finance prefer not to have their hands tied by hypothecation while frequently health ministries and advocates prefer hypothecation on the grounds that these monies cannot, at least in theory, be taken for other purposes. There is also some evidence that it is more feasible to get populations to agree to the introduction of a new "health tax" than to a new tax that would be used for an unspecified purpose.

Sources: Adapted from World Bank (2016): Earmarking for Health. Working Paper. Forthcoming. Washington DC.

**Using Available Public Data to Analyze the Aggregate Impact of the Taxes**

Governments and non-governmental organizations in middle and low-income countries have several challenges when analyzing the effects of increased taxes on unhealthy foods and beverages (that is, alcohol products, SSBs and high calorie foods).[77]

First, the public sector does not release information on prices and sales of taxed products to the public on a regular basis.[78,79] Second, it is also difficult to track and follow consumers' reactions and producers' strategies to deal with the taxes. This is because governments do not normally produce or publish regular data on consumers' shifts between unhealthy and healthy products or, alternatively, between unhealthy products and less taxed but equally risky products. Along the same lines, authorities do not collect information on producers' strategies, such as changes in product content, modifications in product packaging, and pricing strategies to interfere in consumers' expected responses.

Finally, due to this lack of public and consistent information, public and legislative discussions on the economic and health impacts of those reforms are not as effective as they could be. It is often the companies whose products are being taxed that collect more detailed information on the impact, market

[77]An analysis of those challenges in the case of Philippine Sin (tobacco and beer) Tax reform could be found in Kaiser et al. (forthcoming). The authors proposed a monitoring framework with several impact indicators in order to assist the Philippine government in the legislative discussion about the Sin Tax reform progress.

[78] Traditional public statistics in Lower and Middle- Income countries normally display more aggregated information about prices and industrial production/sales, according to a large family of similar products (that is, beverages instead of beer; or combining SSB and bottled water) or a standardized statistical category. Also, countries do not normally have public disaggregated data on retail sales of those products.

[79]Tax administration authorities could also produce statistical information about average prices and sales of the taxed products, because producers and taxpayers may inform those variables on tax forms. This is the case, for example, of tobacco products after the awareness of tobacco harm. Tax authorities of several countries produce public information of duty-paid sales, import, export and detailed and average prices of tobacco products.

trends, and consumer responses to the taxes. Governments conduct limited impact analyses while the producers and sellers that have a vested interest in the effects of taxes, tend to interpret and use their own data and information on the outcomes of the tax reform to their advantage.

Consumption trend analyses are also fundamental to evaluating the impact of a tax policy with a public health aim. The impact of this policy continues to be controversial. Supporters and foes debate about its capacity to improve health outcomes. In Mexico, one of the main controversies surrounding the impact of the taxes is around the extent of reduction of consumption of sugar-sweetened beverages. Despite the importance of this issue for the sustainability of the reform, very little measurement has been done so far on the impact of the tax reform on sales. The National Institute of Public Health has done a rigorous evaluation of the impact of the taxes, using a special survey; this evaluation was published in the British Medical Journal. However, the Government has not published any official statistics on the impact of the taxes on SSBs and high-calorie foods sales. The evidence that is available comes from private sources or academic studies, which are based on privately funded surveys.

This section has several aims. First, to show what type of aggregate data is needed to monitor on a regular basis price and consumption reactions to the tax change in Mexico, and how such data could be obtained from official data sources. It also discusses some price and consumption impact of the recent reform in Mexico, based on academic studies and some examples of public data. Finally, the section proposes options to organize public data to monitor the reform.

**Gathering and Processing Public Data to Monitor the Effects of Taxes on Sugar-sweetened Beverages and Energy-dense Foods of Low Nutritional Value**

Mexico's National Strategy for the Prevention and Control of Overweight, Obesity and Diabetes has a matrix of indicators to monitor and evaluate its results. This monitoring would be carried out by the Mexican Observatory of Noncommunicable Diseases (OMENT).[80] In support to the Health Secretariat and the OMENT, this section proposes a subset of price and volume of sales indicators/indexes to contribute to the monitoring of the effect of the Strategy's fiscal measures on prices, consumption, and substitution of the products being taxed. These proposed indicators are based on publicly available data.

**A Simple Monitoring Framework of Aggregate Impacts of the Taxes**

Table 5 presents the first step of the impact chain of a tax: the price effect. Producers can pass the full extent of the tax to consumers – a likely reaction in concentrated markets – or adopt several softer actions to reduce the impact on prices, seeking to keep consumers in the product market. The last two reactions – craft and non-duty paid production - imply different degrees of tax evasion allowing existing or new producers to sell their products at a lower price, while still maintaining profitability.[81]

In Mexico, as is common in most countries, consumer price information is only publicly available at an aggregate level, such is the case of "refreshments" (*refrescos*). The refreshment category is broad and combines detailed price information on carbonated soft drinks, flavored carbonated and non-carbonated drinks, water and other beverages. Sometimes the publicly available price information may coincide with the aggregation level of the taxed product. When the price information of the product of interest is under a higher level of aggregation, there is a need for an additional step, which is to construct a price index for a subset of the aggregated category. In that case, individual price information would need to be processed to generate a price index that is as close as possible to that of the taxed product.

[80] The Observatory is based in the University of Nueva Leon and is part of a network of academic and commercial institutions cooperating with the National Strategy against Overweight and Obesity.
[81] Before the tax increase, lower prices of tax duty products may not create financial incentives for craft production and non-duty manufactured production of the taxed products.

**Table 5: Price Effect**

| Policy | Individual price reaction | Aggregate price effect |
|---|---|---|
| Tax increase | Fully passed | Increase as expected |
| | More than fully passed | Increased more than expected |
| | Partially passed | Increase less than expected |
| | Cheaper Package | |
| | Craft production | |
| | Non duty paid production | |

The increase in price of the taxed product quantified by the index to be processed may depend on the particular sample of product variants and package sizes that the national statistical office (NSO) usually collects. NSOs do not normally capture well handmade or craft production and may not capture trends related to non-duty paying production, particularly in tobacco and alcohol products. Also, after the tax implementation, new packaging trends -seeking to reduce the cost per quantity of the product- may not be well captured by the sample of product variants of the NSO. Moreover, the consumer price basket may not have detailed information on certain taxed products – that is, large package size of diet cola in Mexico - making it impossible to have a price indicator for this specific product or product category.

Table 6 displays the consumption effect and its components: type of individual consumer reactions, impact on health, effects on aggregate sales of the taxed product and on sales of substitute products. When taxes cause an unhealthy product to become more expensive, consumers can reduce the intake of the product, and receive the consequent health benefits of such decision, or they can select an alternative, cheaper option, such as purchasing packages in bulk with lower price per quantity (common in SSBs). They can also simply select cheaper price brands as substitutes. The indicators to be processed in this stage are sale volumes of the taxed product and of some substitutes.

**Table 6: Consumption Effect**

| Individual Consumer reactions Targeted product | Health Effect | Aggregate effect on targeted product sales | Aggregate effect on sales of substitutes |
|---|---|---|---|
| Quit consumption | Positive | Decrease | May increase |
| Reduce consumption of the same product | Positive | | |
| Switch to cheaper presentation of the same product | None | Increase | No effect |
| Switch to lower-price brand | None | | |

NSOs normally have industrial statistics of production and sales,[82] but they do not have detailed information on volume of retail sales. Under normal business conditions, industrial sales may be a good proxy of consumer purchases within a certain period, a year for example, since retailers do not normally want to maintain unwanted stocks of any product. Available information of industrial sales is normally classified

[82] At industrial level, NSOs can capture directly the sales volume or arrive to that figure adding production volume plus stock variations.

according to an industrial product classification.[83] Consequently, to have a good indicator of industrial sales of a taxed product, it may be necessary to further process sales data of the desired product, if it is not contemplated in published aggregate information. In case of differentiated products such as SSBs and high-calorie foods, the production of sale indicators of as many as possible product variants may be useful. The precise definition of sale indicators of taxed product should balance the actual configuration of consumption and data availability in the statistical office.

The definition of substitute products and the construction of sale indicators of those products are important, as they may help to identify and track the consumer substitution process. Table 7 shows an example of the substitution effect in the case of SSBs. Bottled water and milk are conventional candidates in the substitution process, but the precise configuration of the substitution in a specific situation may depend on relative prices and availability of beverages without added sugar.

**Table 7: Substitution Effect – SSBs**

| Individual Consumer Substitution | Health Effect | Aggregate effect on sales of substitutes |
|---|---|---|
| Bottled Water | Positive | Increase |
| Milk | Depends | |
| Non sugary flavored drinks | Positive | |
| Light or diet carbonated soft drinks | Positive | |

Table 8 presents an example of the substitution effect in the case of energy-dense foods of low nutritional value. In this case, based on the knowledge of food availability and relative prices, substitute products can be defined. Further, it is possible that consumers instead of buying the taxed products might decide to prepare them at home. This behavior could be monitored by keeping track of the ingredients that go into the preparation of these foods, such as sugar, wheat, etc. The analysis of the substitution effect should take this possibility into account.

**Table 8: Substitution Effect – High-calorie Foods**

| Individual Consumer Substitution | Health Effect | Aggregate effect on sales of substitutes |
|---|---|---|
| Less caloric food (?) | Positive | Increase |
| Sugar purchases to prepare sugary and high-calorie products | Negative | |
| Wheat to prepare high-calorie foods | Negative | |
| Fats | Negative | |
| Other equally caloric food preparation (?) | Negative | |

**Elements of a Monitoring Framework for Mexico**

The monitoring framework of the aggregate impacts of taxes on unhealthy products described above has been used in tobacco and alcohol tax reforms. It could be adapted to the Mexican situation and be used to analyze aggregate impacts on prices and sales of taxed products and their substitutes. However, as the

[83] Mexico uses the North America Industrial Classification System, an industrial classification for Canada, USA and Mexico. The NAIC classification, as others used elsewhere, are variants of the Standard International Industrial Classification. Industrial classifications have different levels of product aggregation, and countries publish detailed data in different degrees.

Mexican reform is broad and novel, special care is warranted. First, the efforts should be focused specifically on SSBs and high-calorie foods consumed by Mexicans.[84] Second, to understand the consumption effect in both types of products, it is necessary to analyze all product variants and commercial presentations to evaluate if consumers could substitute them with cheaper alternatives of the same taxed products. Third, to understand the substitution effect, it is important to identify the main healthier consumption alternatives for each taxed product and to consider the relative price of these alternatives vis-à-vis the taxed product, the production capacity for these products, and their distribution network.

In Mexico, the National Institute of Statistics and Geography (INEGI) has a database of individual prices that are collected to generate the Consumer Price Index.[85] The available information in the database allows the processing of detailed price indicators for SSBs since the available price data on individual items of cola and flavored sodas, flavored waters, industrialized juices, and concentrated powder for flavored waters and juices is relatively abundant and closer to the taxed products; similarly for substitute non-taxed beverages such as bottled water and milk. However, there is not as much data on light or diet soft drink prices, reflecting previous shares of these beverages in Mexican consumption. In the case of energy dense foods of low nutritional value, the analysis conducted for this report indicates that the price coverage of these products is more varied, with good coverage for some, such as snacks (*botanas*), sweet breads (*pan dulce*), pancakes and pastries, breakfast cereals (*cereales para el desayuno*), cookies, and for some substitute products, such as milk, yogurt, and fruits.

For this analysis a set of prices for substitute products is also used with the idea that higher demand towards those products, due to substitution from taxed products after the reform, would be reflected in higher prices.[86] Table 9 presents the set of consumer products for which simple average prices were calculated for the period between January 2011 and December 2015. Annex I presents price definitions, average annual values for the whole set of taxed products for which detailed information was available, and average prices for some substitute products.

**Table 9: Taxed Products and Selected substitutes for Which Average Prices were Calculated**

| Product Definition |
|---|
| Snacks (average of the whole family) |
| Potato Chips |
| Corn Fritters |
| Fruit Popsicle |
| Goat milk caramel |
| Fruit and Vegetable Jams |
| Caramel |
| Corn flakes with Sugar |
| Cookies |
| Sweet Bread (in bulk) |
| Industrialized Sweet Bread |
| Pancakes, cakes, pastries |
| Juices and Nectars |
| Soft drinks concentrates |
| Orange Juice concentrates |
| Flavored Powder Drink Mix |

[84] In other words, the universe of taxed food product is broad and the Mexicans consume those food products with different intensity. Health authorities should select a set of high-calorie foods to be monitored according to their importance on overweight and obesity.
[85] This database can be found at http://www3.inegi.org.mx/sistemas/inp/preciospromedio/
[86] Grogger, 2015.

| |
|---|
| Cola sodas |
| Flavored sodas |
| Flavored waters |
| Bottled water |
| Light cola sodas |
| Whole milk |
| Skimmed milk |
| Yoghourt |
| Yoghourt in varied forms |
| Whole Powder Milk |
| Skimmed Powder Milk |
| Whole Wheat Bread |
| Standard sugar |
| Refined Sugar |
| Fresh Fruit |

The price database also allows estimating the average price of different types of packages of the same product and thus it allows a better understanding of business strategies and substitution possibilities. This is particularly important in regular and light cola sodas, and other sweetened soft drinks.

To analyze consumption and substitution effects, it is necessary to obtain detailed sale indicators of taxed and potential substitute products from public data. The present analysis uses volume of sales of the Monthly Survey on Manufacturing Industry.[87] Table 10 presents the selected taxed and substitute products for which sale volumes were available. The data from INEGI does not separate domestic sales from exports. Detailed data on sale indicators are presented in Annex II.

**Table 10: Sales Indicators**

| Products |
|---|
| Snack Foods |
| Potato Chips |
| Corn Fritters |
| Candies, Chewing Gum and non-Chocolate Confectionery Products |
| Fruit Popsicles |
| Goat Milk Caramel |
| Fruit and Vegetable Jams |
| Caramel |
| Sweet Corn Flakes |
| Cookies (with filling or cover) |
| Industrialized Sweet Bread |
| Pancakes, Cakes and Pastries |
| Juices and Fruit Nectars |
| Soft Drinks Concentrates |
| Orange Juice Concentrates |
| Flavored Powder Drink Mix |

[87] The figures of the Monthly Survey of Manufacturing Industry are available at http://www.inegi.org.mx/sistemas/bie/

| |
|---|
| Colas sodas |
| Flavored Sodas |
| Energy or sport drinks |
| Bottled Water |
| Whole Milk |
| Skimmed milk |
| Yoghourt |
| Yoghourt in varied forms |
| Whole Powder Milk<br>Skimmed Powder Milk<br>Whole wheat bread<br>Standard sugar<br>Refined sugar |

The industrial sales data do not distinguish between regular and diet products and between small and large packaging, generating some limitations in the analysis. It is also difficult to capture the substitution effect in the case of taxed energy-dense foods, because there are no sale indicators of alternative products such as fruits or industrialized low calories products. Box 3 explains in detail the limitations of using the INEGI databases on prices and volume of sales for monitoring the effect of these taxes.

**Box 3: Using INEGI Databases for Monitoring the Effects of these Taxes**

The use of INEGI' s CPI and manufacturing industry databases for the analysis of the impact of the taxes on SSBs and foods of low nutritional value presents some limitations. Some of the publicly available data do not fully reflect the types of goods under taxation; in some cases it is possible to disaggregate the data further to better reflect the goods, in other cases, such as light soda versions, these data do not exist. Additionally, the data on volume of goods do not differentiate between goods for internal consumption and those for export. As a result, for INEGI databases to be used to construct effective indicators to continuously monitor the impact of this fiscal policy on prices and volumes some changes in the data would be needed.

Some specific examples of the limitations linked to the use of INEGI data are detailed in the table below. The table focuses on the limitations related to price data. The second column of the table presents INEGI's available data and the third the actual data needed to effectively monitor the fiscal policy.

| | Available data | Necessary data | Notes |
|---|---|---|---|
| **Price of the taxed products** | **SSB** | **SSB** | **SSB** |
| | Bottled Juices and Nectars | Juices and Nectars | |
| | Other foods- Soft drink concentrates | Soft drinks concentrates | |
| | Other foods- Soft drink concentrates | Flavored Powder Drink Mix | |
| | Bottled refreshments | Regular carbonated soft drinks | Very aggregated level |
| | | Flavored Carbonated drinks | |
| | | Flavored non-carbonated drinks | |
| | **Substitutes** | **Substitutes** | **Substitutes** |
| | Bottled water | Bottled water | |
| | Bottled refreshments | Non sugary flavored drinks | Larger sample of diet and non-sugary drinks |
| | Bottled refreshments | Light or diet carbonated soft drinks | |
| | **High calorie foods** | **High calorie foods** | **High calorie foods** |
| | Less coverage of taxed products in the CPI. Not enough data on some products, for example: chocolate and other cocoa derivate products, crème caramel and pudding, fruit and vegetable sweets, peanut and hazelnut cream, etc. | Identification of key products to monitor | The number of taxed products is large. The most consumed high calorie products should be selected. The prices of those products should be monitored. |
| **Sales of taxed products** | Volume of sales of the Monthly Survey on Manufacturing Industry | Domestic sales of the main taxed products | Sales volumes add export and domestic sales. Need to disaggregate |
| | | Light or diet drinks | It is not possible to construct an indicator of diet drinks sales |

**Analysis of Price, Consumption and Substitution Effects of the Tax Reform**

This subsection discusses the available evidence on the price, consumption and substitution effects of the tax reform using the findings of academic studies and the evidence gathered from price and sale indicators constructed for this study using publicly available data.

Sugar-sweetened beverages

Mexico has a large and diversified supply of SSBs. According to the Household Income and Expenditure Survey (ENIGH, 2014), household consumption is highly concentrated on sodas (cola, flavored, and light), representing 82 percent of total SSBs consumption; juices contribute 13 percent; and concentrates and flavored powders contribute only 4 percent of total household consumption of SSBs.[88] Before the implementation of the tax reform, there were large price differentials between the main types of SSBs in the country. Table 11 shows averages prices for main types of SSBs, light sodas, and bottled water during 2013.

**Table 11: Average Prices of SSBs, Light Sodas, and Bottled Water – Annual Average (MXN)**

| Product | Unit | 2013 |
|---|---|---|
| Juices and Nectars | liter | 16.8 |
| Soft drinks concentrates | 1 liter of concentrate produces 5.6 liter of flavored drink | 4.5 |
| Flavored Powder Drink Mix | 1Kg produces 25 liters of juice | 6.6 |
| Cola sodas | liter | 12.5 |
| Light cola sodas | liter | 15.4 |
| Flavored sodas | liter | 11.1 |
| Flavored waters | liter | 11.5 |
| Bottled water | liter | 6.3 |

Source: CPI – Average prices (http://www3.inegi.org.mx/sistemas/inp/preciospromedio)

There are, at least, two important features of the relative price structure of SSBs and light sodas presented in Table 11. First, cola sodas were cheaper than their light versions and the price differential was almost MXN 3.[89] Second, concentrates and flavored powders seemed to represent a substantially cheaper alternative. However, after adding the price of bottled water or soda water (around MXN 6.3), the flavored powder drink price becomes MXN 12.9 and concentrate soft drink price becomes MXN 10.8, similar to cola sodas and flavored sodas, respectively. This could explain why, despite lower prices per liter equivalent, those products maintain a low participation in the Mexican market.

The high price differentials between light and regular soda, and the similar price of industrialized flavored soda drinks with those produced by concentrates and powders hinted that the substitution away from regular soda and flavored soda would be difficult after the reform. A closer look at average prices per brand and package size of different types of sodas could further illustrate this difficulty of the Mexican reform (Table 12). Price differentials between regular and diet soda average prices of the same package size appear smaller than in Table 11 (aggregate averages), nevertheless they were substantial in the case of 1 liter bottles (MXN 1.5).

[88] Universidad Autónoma de Nueva León.2015.

[89] This comparison involves different composition of package size for the samples of regular and light sodas. Light sodas were represented with smaller packages, which are more expensive. Nevertheless, the differences for the same package were substantial in 2013, as shown in Table 12.

**Table 12: Average Pper Liter of Sodas (MXN)**

| Products | December 2013 |
|---|---|
| **Coke** | |
| Can 335 up to 6 pcs. | 21.0 |
| 600 ml | 14.9 |
| 600 ml light | 15.7 |
| 1 liter light | 13.7 |
| 1 liter regular | 12.2 |
| 2 liters regular | 9.73 |
| **Pepsi** | **December 2013** |
| 2 L regular | 7.6 |
| **Flavored sodas** | **December 2013** |
| Jarritos 2 L | 5.4 |
| Fanta 2L | 7.0 |
| Mirinda 2L | 7.7 |
| **Price difference between 2L presentation** | **December 2013** |
| Coke - Pepsi | 2.13 |
| Coke - Fanta | 2.68 |
| Pepsi- Mirinda | -0.15 |
| Fanta - Jarritos | 1.62 |

Source: CPI – Average prices

The two-liter packages in Table 12 seem to better reflect the consumption pattern of households. Consumers of 2 liter packages might have had some substitution options among regular and flavored sodas at the reform implementation. The price difference between Coke and Pepsi was more than MXN 2 and between Coke and its flavored soda, Fanta, was MXN 2.68, making it possible to switch to those cheaper options after the reform implementation.

What have the academic studies concluded about the price effects of the reform? Up to now, price response of the SSBs has been the most studied effect of this reform. Grogger (2015) used the CPI database of individual prices to estimate average prices of taxed products - regular sodas and other drinks with added sugar (juice drinks and flavored waters) - and four untaxed substitutes – diet soda, bottled water without sugar, milk and pure juice. Price changes of substitute products might provide indirect evidence on consumer substitution patterns. Grogger controlled for inflation using real prices and analyzed other non-beverage product prices. Grogger's main conclusions were: (i) regular soda prices increased more than MXN 1 relatively to December 2013; (ii) other SSBs augmented less than 1 peso and may have fallen again by the end of the period analyzed (March 2015); (iii) there was some substitution towards diet soda; (iv) there was no evidence of substitution towards water, milk and pure juice; and (v) real prices of control products (butter, cheese, chicken, dried beans and bread) were not significantly different from the pre-tax situation (December 2013), so he could not find that "real prices in Mexico were rising generally in such a way that could explain the real price increases for regular sodas, other SSBs, and diet sodas that began immediately upon the imposition of the tax" (Grogger, 2015, page 16).

Colchero et al. (2015b) also gathered prices of beverages from the CPI database to measure the price impact of the soda tax. They created two categories: aggregated carbonated SSBs such as soft drinks, and non-carbonated SSBs such as juices and flavored waters. They assessed the impact of taxes regressing real prices of those two price categories on monthly dummies and other variables affecting prices, and comparing the post-reform monthly situation with the 2013 average. They found that price increase for all SSBs was close to one peso per liter after January 2014, but, as seen by Grogger, the price increase was greater for carbonated SSBs (over-shifting), and much lower than one peso per liter (under-shifting) for non-carbonated SSBs.[90] They also found heterogeneity in the regional responses, with over-shifting in

[90] They attributed this result to the fact that non-carbonated soft drinks have higher prices, lower market share in consumption and higher price elasticity.

Mexico City, Central North, North Border and the Northwest, but under-shifting in the rest of the country, particularly in the poorer South. The results, stratified by package size for carbonated sweetened beverages and noncarbonated sweetened beverages, showed that price changes were higher among the beverages with smaller package sizes (600ml), which is consistent with the fact that larger package sizes have higher demand elasticity and are likely to be consumed by lower income families. Finally, their descriptive analyses showed that prices of untaxed beverages did not changed after the SSB tax was implemented (except for sparkling water). This is the case of still plain water and diet soft drinks whose prices were increasing long before the tax.

It is possible to summarize those findings as follows: (i) the prices of soda drinks tended to increase at the same rate as the tax or more; (ii) prices of smaller packages increased more than 1 peso per liter and larger packages increased around 1 peso; (iii) prices of other SSBs (flavored waters and industrialized juices) increased less than 1 peso; (iv) it is not clear if diet soda prices were affected; and (v) there were regional differences on price setting. Grogger and Colchero et al. worked with aggregate values for regular soda drinks, adding cola and flavored soda drinks, but it is possible to further disaggregate both products to observe whether consumers may move from cola towards flavored sodas, which are cheaper options compared to other sugar sweetened beverages. The authors aggregate the non-carbonated sweetened drinks for estimation purposes, but this strategy could also conceal substitution movements of regular cola consumers.

**Table 13: Real Average Prices of SSBs and Light Sodas, Bottled Water and Milk 2013 Prices**

| Product | Unit | 2013 average | December 2013 | 2014 | 2015 |
|---|---|---|---|---|---|
| Juices and Nectars | liter | 16.8 | 17.0 | 17.0 | 16.8 |
| Soft drinks concentrates | 1 liter of concentrate produces 5.6 liter of flavored drink | 4.5 | 4.6 | 5.6 | 6.9 |
| Flavored Powder Drink Mix | 1Kg produces 25 liters of juice | 6.6 | 6.3 | 6.2 | 6.1 |
| Cola sodas | liter | 12.5 | 12.9 | 13.7 | 13.7 |
| Light cola sodas | liter | 15.4 | 15.9 | 16.0 | 16.1 |
| Flavored sodas | liter | 11.1 | 11.2 | 12.2 | 12.3 |
| Flavored waters | liter | 11.5 | 11.9 | 12.1 | 11.5 |
| Bottled water | liter | 6.3 | 6.3 | 6.1 | 6.0 |
| Whole Milk | liter | 13.1 | 14.1 | 13.1 | 13.3 |
| Skimmed Milk | liter | 14.5 | 15.2 | 14.4 | 14.3 |

Source: CPI – Average prices

Table 13 presents the price behavior of real average prices for SSBs and four substitutes, calculated using the CPI database. Comparing average 2013 values with 2014 and 2015 values, it is possible to reach conclusions similar to those found in the academic studies. Cola and flavored sodas passed more than the tax amount to consumers and kept the new real value of both types of products in 2015. Juices and nectars and flavored powders were not able to pass the tax amount to prices and reduced the real value of their products in 2015. Soft drink concentrates were able to pass more than the tax amount and increased real prices in 2015. This could be a sign of consumers switching to this product from flavored sodas and waters. Flavored waters tried to partially pass the tax to their consumers in 2014, but prices returned to their 2013 values in 2015. As in Grogger, there is no price indication that SSB consumers are substituting SSBs with bottled water or milk.

A closer look at the price behavior across brands and package sizes could shed some light on producers' strategies to keep consumers faithful to the soda market. Table 14 presents average prices of different brands and package sizes for cola and flavored sodas. Coke passed more than one peso on packages of over one liter, which are its economic presentations directed to families and lower income population. For less than one-liter packages, Coke passed between two and two and a half pesos, representing an over-shifting of tax to prices. For smaller presentations, the liter equivalent is more expensive, and, according to Fuentes Castro and Zamudio Carrillo (2014), demand elasticity lower (inelastic). The price of light Coke versions were increased around 1 peso in the 600 ml and the liter presentations. In 2015, nominal prices were almost maintained for packages of less than one liter, but the pricing strategy for 2 liters of regular soda appeared as more aggressive, which could be a signal of higher demand for this presentation. Table 14 also shows that the reform managed to eliminate the high price differential between light and regular versions of the same presentation, which was an undesirable feature of the Mexican market.

**Table 14: Nominal Average Prices per Liter of Different Soda Brands and Package Sizes**

| Products | December 2013 | December 2014 | Absolute Variation Dec 2014/Dec 2013 | Relative variation Dec 2014/Dec 2013 | December 2015 | Absolute Variation Dec 2015/Dec 2014 | Relative variation Dec 2015/Dec 2014 |
|---|---|---|---|---|---|---|---|
| **Coke** | | | | | | | |
| **Can 335 up to 6 pcs.** | 21.0 | 23.5 | 2.5 | 12.0% | | | |
| **600 ml** | 14.9 | 16.9 | 2.0 | 13.2% | 17.1 | 0.19 | 1.1% |
| **600 ml light** | 15.7 | 16.8 | 1.2 | 7.5% | 16.8 | -0.01 | 0.0% |
| **1 liter light** | 13.7 | 13.4 | -0.3 | -2.2% | 14.1 | 0.70 | 5.2% |
| **1 liter regular** | 12.2 | 13.5 | 1.3 | 10.8% | 14.0 | 0.50 | 3.7% |
| **2 liters regular** | 9.73 | 11.1 | 1.3 | 13.6% | 11.9 | 0.86 | 7.8% |
| **Pepsi** | **December 2013** | **December 2014** | **Absolute Variation Dec 2014/Dec 2013** | **Relative variation Dec 2014/Dec 2013** | **December 2015** | **Absolute Variation Dec 2015/Dec 2014** | **Relative variation Dec 2015/Dec 2014** |
| **2l regular** | 7.6 | 9.4 | 1.8 | 23.7% | 9.6 | 0.23 | 2.4% |
| **Flavored sodas** | **December 2013** | **December 2014** | **Absolute Variation Dec 2014/Dec 2013** | **Relative variation Dec 2014/Dec 2013** | **December 2015** | **Absolute Variation Dec 2015/Dec 2014** | **Relative variation Dec 2015/Dec 2014** |
| Jarritos 2 L | 5.4 | 6.7 | 1.3 | 23.4% | 6.8 | 0.14 | 2.2% |
| Fanta 2L | 7.0 | 8.8 | 1.7 | 24.2% | 9.0 | 0.29 | 3.3% |
| Mirinda 2L | 7.7 | 8.8 | 1.1 | 13.6% | 10.2 | 1.44 | 16.4% |
| **Price difference between 2L presentation** | **December 2013** | **December 2014** | | | **December 2015** | | |
| Coke - Pepsi | 2.13 | 1.66 | | | 2.29 | | |
| Coke - Fanta | 2.68 | 2.30 | | | 2.88 | | |
| Pepsi- Mirinda | -0.15 | 0.59 | | | -0.62 | | |
| Fanta - Jarritos | 1.62 | 2.06 | | | 2.20 | | |
| **Relative Prices in 2L presentation** | | | | | | | |
| Coke/Pepsi | 28.1% | 17.7% | | | **23.8%** | | |
| Coke/Fanta | 38.1% | 26.3% | | | **31.9%** | | |
| Pepsi/Mirinda | -1.9% | 6.7% | | | **-6.1%** | | |
| Fanta/Jarritos | 29.9% | 30.7% | | | **32.2%** | | |

Source: CPI – Average prices

Table 14 also gives us some indication of potential consumption substitutions among different types of sodas. The first potential substitution is from smaller presentations to larger presentations with a cheaper value per 1 liter of the product. Both Coke and Pepsi increased the price of the 2 litter presentation in more than the amount of the tax, anticipating higher demand from consumers seeking to buy the cheapest package of sodas. Pepsi increased more than Coke, since with the price differential previous to the reform (2.13 pesos), they could capture Coke consumers seeking to find a cheaper 2 liter soda bottle. The second potential substitution is between cola and flavored sodas. The price of Fanta was 1.7 pesos higher in December 2014, reducing its price differential with Coke and increasing its differential to Jarritos (a popular version of flavored soda). This could be the result of higher demand towards flavored sodas, which is also observed in the price increase of Jarritos (more than 1 peso).

Colchero et al. (2016) found that the post-tax purchases of SSBs during the first year were 6 percent lower on average than the pre-tax trend, or in other words "compared with expected purchases with the tax absent" (page 5). They also found that purchases of untaxed beverages were 4 percent higher than the similar counterfactual, mainly related to bottled water. They found that the reduction in purchases of non-carbonated taxed beverages was larger than the reduction in carbonated taxed beverages. This could be

due to higher prices and high price elasticities of non-carbonated beverages; and consumers shifting to lower priced versions of taxed carbonated beverages given the large variation in prices.

**Table 15: Indexes of Industrial Sale Volumes of SSBs and Possible Substitutes (volume of sales of 2013=1)**

| | Juices and Nectars | Soft drinks concentrates | Orange Juice Concentrates | Flavored Powder Drink Mix | Cola sodas | Flavored Sodas | Bottled Water | Energetic drinks | Other juices | Whole Milk | Skimmed Milk | Total Manufacturing Industry |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2007 | 0.88 | 1.09 | 0.48 | 2.28 | 0.81 | 0.98 | 0.82 | 0.86 | 0.64 | 1.07 | 1.01 | 0.92 |
| 2008 | 0.94 | 1.26 | 0.66 | 2.31 | 0.82 | 0.91 | 0.84 | 0.86 | 1.23 | 1.11 | 1.05 | 0.91 |
| 2009 | 1.04 | 1.12 | 0.74 | 2.16 | 0.83 | 0.99 | 0.88 | 0.73 | 1.30 | 1.10 | 1.06 | 0.84 |
| 2010 | 0.89 | 1.01 | 0.63 | 1.28 | 0.88 | 0.99 | 0.91 | 0.72 | 0.97 | 1.05 | 1.01 | 0.91 |
| 2011 | 0.93 | 1.05 | 0.85 | 0.56 | 0.96 | 1.03 | 0.96 | 0.90 | 1.10 | 0.99 | 0.99 | 0.95 |
| 2012 | 0.96 | 1.00 | 0.67 | 1.16 | 0.98 | 1.02 | 1.00 | 1.14 | 1.04 | 0.84 | 0.99 | 0.99 |
| 2013 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 2014 | 1.01 | 1.03 | 0.96 | 1.08 | 0.99 | 0.97 | 1.05 | 1.31 | 1.14 | 0.91 | 0.96 | 1.04 |
| 2015 (10 months) | 1.02 | 0.86 | 0.86 | 0.94 | 0.98 | 0.97 | 1.24 | 1.26 | 1.37 | 0.80 | 0.98 | 1.07 |
| **Annual Variation rates** | | | | | | | | | | | | |
| 2011/2013 | 5.9% | -0.6% | 28.8% | -10.9% | 7.1% | 0.7% | 4.9% | 19.7% | 1.5% | -2.6% | -0.3% | 5.1% |
| 2014/2013 | 0.6% | 3.1% | -4.5% | 7.6% | -1.4% | -3.0% | 5.2% | 30.8% | 14.2% | -9.2% | -4.1% | 3.9% |
| 2015/2014 | 1.8% | -16.7% | -9.8% | -12.6% | -0.3% | -0.3% | 17.7% | -3.9% | 19.7% | -12.4% | 1.7% | 3.3% |

Source: authors' elaboration based on the Monthly Survey of Manufacturing Industry (EMIM)

Table 15 presents physical sales indexes generated with data on volume of sales (quantities) from the Monthly Survey of Manufacturing Industry (EMIM).[91] They were prepared for the available SSBs and for some potential substitutes, such as bottled water, whole and skimmed milk. Also, a total manufacturing index of physical production is presented as a proxy for the trend in industrial activity in Mexico. As mentioned, these indexes include domestic and export sale volumes. Given the high volatility of some indexes between 2007 and 2010 due to the economic crisis of 2009, previous annual growth rates were estimated only for the period 2011-2013 and annual rates were presented for 2014 and 2015. The behavior of cola and flavored sodas are aligned with the Colchero's et al. results: there was a contraction in the volume of sales of carbonated beverages. However, 2014 growth rates of sales of non-carbonated sweetened beverages were positive, except for orange juice concentrates. Although, these indexes need to improve, it is possible to state that the positive association between total manufacturing growth and growth rates of juices and nectars, cola and flavored sodas previous to the reform was not present in 2014. The 2015 figures represent only 10 months and are preliminary, but the lack of positive association remains between the general industrial growth rate and the soda growth rates. In terms of evidence of substitution, the growth rate of the volume of sales of bottled water increased. The milk sales indexes do not indicate a growth in the demand of these products.

### Energy-dense Foods of Low Nutritional Value

Table 16 presents the average price behavior for selected taxed foods – snacks (potato chips and corn fritters), fruit popsicles, corn flakes with sugar, sweet breads (handcrafted and industrialized), pancakes, cakes and pastries – and a potential substitute –whole wheat bread. The table also displays growth rates

[91] To construct those indexes sales volumes for each product were taken. The volume of sales of 2013 was considered as 1.

of those prices for the first and second year of the reform, and annual average growth rates, before the reform. The last row shows the average annual inflation rate for the same years.

**Table 16: Nominal Average Prices and Growth Rates of Selected Taxed Foods and Whole Wheat Bread**

| Product | Unit | 2013 average | December 2013 | 2014 | 2015 | Annual Variation Rates | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | 2014/2013 | 2015/2014 | 2013/2011 |
| Snacks (average of the whole set of snacks) | KG | 144.8 | 148.1 | 160.0 | 166.7 | 10.5% | 4.2% | 6.8% |
| Potato Chips | KG | 165.0 | 170.0 | 184.2 | 193.6 | 11.6% | 5.1% | 6.8% |
| Corn Fritters | KG | 112.6 | 115.6 | 129.8 | 133.6 | 15.2% | 3.0% | 5.3% |
| Fruit Popsicle | KG | 95.7 | 99.3 | 117.2 | 120.3 | 22.6% | 2.6% | 11.5% |
| Corn flakes with Sugar | KG | 63.0 | 62.8 | 67.5 | 66.7 | 7.2% | -1.2% | 5.9% |
| Sweet Bread | Piece | 4.8 | 4.8 | 5.2 | 5.2 | 9.9% | -1.4% | 8.3% |
| Industrialized Sweet Bread | KG | 87.6 | 90.7 | 101.8 | 106.4 | 16.3% | 4.4% | 5.4% |
| Pancakes, cakes, pastries | KG | 116.7 | 120.9 | 134.0 | 137.7 | 14.9% | 2.7% | 9.5% |
| Whole Wheat Bread | KG | 41.8 | 43.2 | 44.2 | 45.9 | 5.6% | 4.0% | 3.4% |
| Total CPI | | | | | | 4.02% | 2.72% | 4.04% |

Source: CPI – Average prices

The growth rates of the prices of selected taxed foods were above the total inflation rate before the reform (Table 16, last column). This could be reflecting existing demand pressures but more research on consumption trends, product innovations, and product supply developments in those sectors is needed to better understand the causes of these high rates. In contrast, industrialized whole wheat bread prices were growing below overall inflation rates. The table also shows that the growth rate of the prices of all taxed products increased in the first year of the reform. If a producer adjusted the price of its product by the expected inflation (around 4 percent) and the tax increase on high-calorie foods (8 percent), he/she would have increased his/her prices by about 12 percent. The table shows that except for corn flakes and handcrafted sweet breads, the rest of the taxed products increased their prices near 12 percent or more. Interestingly, the growth rate of the price of whole wheat bread in 2014 was higher than overall inflation, indicating a higher demand pressure over this product.

The price behavior of the second year of the reform was mixed. Lower demand towards those products should be reflected on price growth rates below total inflation rates. However, the table shows price reductions –corn flakes and handcrafted sweet breads-; price growth rates near the overall inflation – corn fritters, fruit popsicles and pancakes and pastries-; and growth rates clearly over overall inflation – potato chips and industrialized sweet breads. A look to industrial sales could elucidate what happened with demand and supply after the reform.

**Table 17: Indexes of Industrial Sales of Selected High-calorie Foods and a Potential Substitute (2013=1)**

| | Snacks (average of the whole product) | Potato Chips | Corn Fritters | Fruit Popsicle | Corn flakes with Sugar | Industrial-ized Sweet Bread | Pancakes, cakes, pastries | Whole Wheat Bread | Total Manufacturing Industry |
|---|---|---|---|---|---|---|---|---|---|
| 2007 | 0.86 | 0.97 | 0.76 | 0.92 | 0.86 | 0.96 | 0.93 | 0.85 | 0.92 |
| 2008 | 0.85 | 0.84 | 0.83 | 1.04 | 0.91 | 0.90 | 0.93 | 0.82 | 0.91 |
| 2009 | 0.86 | 0.84 | 0.84 | 1.07 | 1.02 | 0.88 | 0.97 | 0.75 | 0.84 |
| 2010 | 0.91 | 0.84 | 0.91 | 1.06 | 1.06 | 0.88 | 0.98 | 0.80 | 0.91 |
| 2011 | 0.93 | 0.90 | 0.92 | 1.04 | 1.06 | 0.88 | 1.00 | 0.90 | 0.95 |
| 2012 | 0.99 | 0.94 | 0.99 | 1.09 | 1.03 | 0.97 | 1.03 | 0.96 | 0.99 |
| 2013 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 2014 | 0.97 | 0.91 | 0.98 | 0.90 | 0.91 | 0.94 | 0.99 | 1.04 | 1.04 |
| 2015 (10 months) | 1.02 | 1.02 | 1.02 | 0.94 | n.d | 0.89 | 1.02 | 1.03 | 1.07 |
| **Annual Variation rates** | | | | | | | | | |
| 2011/2013 | 5.1% | 9.5% | 5.0% | -2.9% | -2.8% | 6.7% | 0.9% | 12.2% | 5.1% |
| 2014/2013 | -2.8% | -8.7% | -1.6% | -10.5% | -8.7% | -6.2% | -1.3% | 4.3% | 3.9% |
| 2015/2014 | 5.4% | 11.6% | 3.9% | 4.5% | n.d | -5.0% | 3.8% | -1.2% | 3.3% |

Source: authors' elaboration based on the Monthly Survey of Manufacturing Industry (EMIM)

Table 17 shows the indexes of sale volumes of the selected taxed foods and industrialized whole wheat bread. The table also shows an index of industrial production to compare the annual behavior of the selected products with the overall behavior of the industry. There is no sale index of handcrafted sweet breads. The table also displays the annual growth rates of sale volumes before the reform (2011-2013) and the yearly response after it.

Table 17 gives us important elements of what was the situation of the sectors before the reform and formulates some questions about the post–reform sales behavior. The hypothesis that some of those taxed products were facing demand pressures is confirmed by higher growth rates of the volume of sales of these products than the overall industry rate. For example, snacks were augmenting their prices above total inflation and were growing above the overall industry. Industrialized sweet breads present a similar price and sale volume behavior. However, not all product price increases were related to demand pressures. Three sectors had contraction or lower-than-average growth in the pre-reform period – popsicles, corn flakes and pancakes and pastries -, but they increased their prices above overall inflation rates.

The most interesting result after the reform is the generalized contraction in the first year, a year of overall industrial growth (3.9 percent) in Mexico. However, the hypothesis that whole-wheat bread could be a substitute was not confirmed, since the sector grew below the overall industry, after years of good speeder growth. The second year of the reform was rather disappointing, because several sectors experienced a recovery, leading in some cases to higher levels of sales when compared to 2013 – i.e. snacks and pancakes –. As a positive impact of the reform, sales volumes of fruit popsicles and sweet bread remained below the 2013 levels.

### Comparing Prices of Taxed Products in Mexico with other Countries and Implications of these Differences

Soft drinks in Mexico, even after the tax reform, are cheaper than in comparator countries like Argentina and Brazil. Table 18 presents the price per liter in packages of 2 liters of different sodas and the ratio of the price of 200 liters to GDP per capita. The table also shows the price per liter of the Coke and Fanta sale

promotion made in Brazil and Mexico and the Coke and Sprite sale promotion in Argentina.[92] To buy 200 liters of coke (in 100 packages of 2 liters), Argentinians have to spend 2.6 percent of their income, Brazilians 1.9 percent, while Mexicans need to spend only 1.5 percent. To buy the same quantity of Fanta, Brazilians have to spend 2.06 percent of their per capita income, Argentinians 2.4 percent, while Mexicans spend less than half of that (1.1 percent). In Mexico, Coke Zero is relatively cheaper than in Brazil and Argentina and availability of light sodas of 2 liters in internet shopping seems to be higher in Mexico and Argentina. Finally, attention should be paid to sales promotion. The combo of 2 Coke and 2 Fantas of 2 liters package is in Mexico and Brazil, but the price per liter is one third in Mexico vis-à-vis Brazil.

**Table 18: Price per Liter and the Ratio of 200 Liters Price to GDP Per capita: Brazil, Argentina and Mexico 2016**

| BRAZIL | Coke | Coke light | Fanta | Coke (4l)+Fanta (4L) =8L | Coke Zero | Pepsi regular | Pepsi light |
|---|---|---|---|---|---|---|---|
| **Price per liter of 2 liter package (LCU) - Source: Pao de Acucar** | 2.68 | n.d | 2.95 | 2.70 | 2.70 | 2.50 | n.d |
| **Price in Dollars (LCU/Dollar: 3.64; April 9,2016)** | 0.74 | | 0.81 | 0.74 | 0.74 | 0.69 | |
| **Ratio of 200 L/ GDP per Capita 2015- Source: WEO- IMF database** | 1.9% | | 2.06% | 1.89% | 1.89% | 1.75% | |
| **MEXICO** | **Coke** | **Coke light** | **Fanta** | **Coke (4l)+Fanta (4L) =8L** | **Coke Zero** | **Pepsi regular** | **Pepsi light** |
| **Price per liter of 2 liter package (LCU) - Source: Superama** | **11.25** | **11.50** | **8.2** | **4.375** | **9.5** | **9.65** | **10** |
| **Price in Dollars (LCU/Dollar: 17.4; April 8,2016)** | **0.65** | **0.66** | **0.47** | **0.25** | **0.55** | **0.55** | **0.57** |
| **Ratio of 200 L/ GDP per Capita 2015- Source: WEO-IMF data** | **1.5%** | **1.5%** | **1.1%** | **0.6%** | **1.3%** | **1.3%** | **1.3%** |
| **ARGENTINA** | **Coke** | **Coke light** | **Fanta** | **Coke (2.2l)+Sprite (2.2L) =4.4L** | **Coke Zero** | **Pepsi regular** | **Pepsi light** |
| **Price per liter of 2.2 Liter package (LCU) - Source Disco Supermarket** | 15.63 | 15.49 | 14.68 | 13.63 | 15.49 | 14.68 | 14.40 |
| **Price in Dollars (LCU/Dollar:14.6913; April 6, 2016** | 1.06 | 1.05 | 0.99 | 0.93 | 1.05 | 0.99 | 0.98 |
| **Ratio of 200 L/ GDP per Capita 2015- Source: WEO-IMF data** | 2.6% | 2.6% | 2.4% | 2.2% | 2.6% | 2.4% | 2.4% |

Sources: Prices: Pão de Açúcar – Brazil (http://www.paodeacucar.com.br/secoes/C4215/sucos-e-refrescos?&ftr=facetSubShelf_ss:4215_Sucos%20e%20Refrescosazil ) and Superama – Mexico (http://www.superama.com.mx/superama/Categoria.aspx?Departamento=d_jugos_y_bebidas). Exchanges rates: Banco de Mexico and Banco Central do Brasil. GDP per capita in LCU World Economic Outlook – International Monetary Fund database

Table 18 also shows that regular sodas prices are lower in terms of GDP per capita in Mexico, which means that it is more affordable for Mexicans to buy sodas than for Brazilians or Argentineans. Moreover, sales promotions are still facilitating the purchase, reducing in more than a half the normal price of 2 liters sodas. Consequently, there is space to consider further increases of the tax per liter and to regulate the discount made in sales promotions.

[92] These prices were collected on March 2016, more than two years after the implementation of the reform in Mexico. GDP per capita of 2015 were used because those estimations are more robust than 2016 and because retail prices were closer to the end of 2015.

**Next Steps**

Fiscal policy for health promotion is still a controversial issue. Governments and advocates of higher taxes to reduce risky consumption need to show the potential of the measure to effectively induce a consumption reduction and substitution towards healthier products. This is the case since first, these reforms are new and need to be tested, particularly in the case of soda or high-calorie foods. Second, they affect a selected group of producers in the economy. Special tax changes are not accepted as generalized taxation and thus they are more likely to generate opposition from the affected businesses. Third, these reforms lead to higher prices and reduced sales. Therefore, they may represent a negative shock for businesses and profit strategies of those affected producers. Fourth, these reforms may have small consumption reduction effect – people simply substituting for cheaper taxed products or for non-duty paying equally unhealthy products. Without a reduction in consumption, there will not be health benefits. Given the importance of monitoring the reduction in consumption after the reform for political and health reasons, consumption indicators of taxed products and substitutes (healthy and unhealthy) are important to construct and may become tools for the necessary debate about effectiveness of the reform design and implementation.

For all those reasons, governments implementing these reforms should process public data to develop indicators of impacts on prices, consumption reduction and substitution behavior to infer economic and health gains. This report presented a simple monitoring framework and used publicly available data to produce average prices (table 11-14 and 16) to present price reactions, and industrial sale indexes (table 15 and 17), to discuss the consumption and substitution effects, to build a picture of the post reform situation. With indicators of this type, authorities and supporters of the reform have the tools to discuss the effects and to show positive impacts and questions to be researched.

The proposed methodology and indicators estimation should be further developed. A joint effort of health, statistical and tax authorities could improve the precision and quality of the processed and published information. For example, in price averages, such kind of cooperation between authorities could refine and standardize product definition, making aggregation closer to the taxed products. In the sale indicators, domestic and export sales could be separated for a standardized taxed product. This is a first and necessary step. But, sale indicators could be improved in several directions in order to capture healthier substitution, for example, differentiating light or non-added sugar production from sugar sweetened versions in beverages.

Finally, since the impact of this fiscal policy on health outcomes is the expected result from a public health stand point, it is key to also monitor the health impact of this and other policies included in the National Strategy for the Prevention and Control of Overweight, Obesity and Diabetes. Thus the need to monitor closely not only prices and volumes of the goods subject to taxation, but also BMI across gender and age groups. However, there is no readily available data to do this on a country level, beyond the data collected every six years in the ENSANUT surveys and thus there is a need to generate this information on a more continuous basis.

# VI. CONSUMPTION PATTERNS ACROSS POPULATION GROUPS LINKED TO THE TAXED FOODS AND BEVERAGES

**Data and Limitations**

This section is based on an analysis of a series of Household Income and Expenditure Surveys (ENIGH). It uses data from 9 years: 1989, 1994, 2000, 2004, 2006, 2008, 2010, 2012, and 2014.

There are important limitations in the use of these surveys to analyze the consumption patterns linked to the foods and beverages subject to the taxes, let alone to analyze the impact of the taxes. Thus the results presented in this section should be interpreted with caution.

The surveys report consumption at the household level and not at the individual level. They report consumption during a reference week though it is not possible to determine whether the product basket consumed during that week was that of a typical week. In addition, the analysis is only based on consumption of goods purchased by the family (the survey also provides information on products given to the family in kind). That said, the results only change slightly when consumption of goods provided in kind are included in the analysis.

One of the main limitations of the data for this analysis is that the surveys report consumption of aggregate categories of products and often these categories do not correspond to the goods taxed. For instance, it is not possible to differentiate between regular and light sodas in the survey data. However, since the market of light beverages in Mexico is relatively small, for the purpose of this analysis we will assume that all sodas, juices and powder juices are subject to the tax.

**Table 19: Proportion of Households that Report Consuming at least one Meal Outside the Household during the Reference Week per Income Quintile**

| | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|
| Poorest | 0.267 | 0.226 | 0.293 | 0.252 |
| II | 0.364 | 0.33 | 0.395 | 0.351 |
| III | 0.46 | 0.421 | 0.469 | 0.44 |
| IV | 0.527 | 0.52 | 0.57 | 0.491 |
| Richest | 0.655 | 0.684 | 0.718 | 0.681 |
| Total | 0.455 | 0.437 | 0.489 | 0.443 |

Source: Own elaboration based on ENIGH survey data

Finally, it is not possible to account for consumption outside the house. This limitation could also affect the estimates since eating outside the household is quite common in Mexico across all income levels (Table 19). In this case, our estimates could be affected since the literature suggests that individuals tend to consume more calories per meal when they consume food outside the house. [93] All this said, the IEPS does not apply to foods and beverages served at restaurants, lessening this potential limitations of the data in the analysis.

In recent years the surveys incorporated new products, however to allow for a better comparison during the 25-year period, a more limited set of products was analyzed. More specifically, the analysis considers all consumption of sodas, juices and powder juices as being SSBs. The analysis considers water and milk consumption as potential substitute goods. For the analysis of the second tax, the following products were

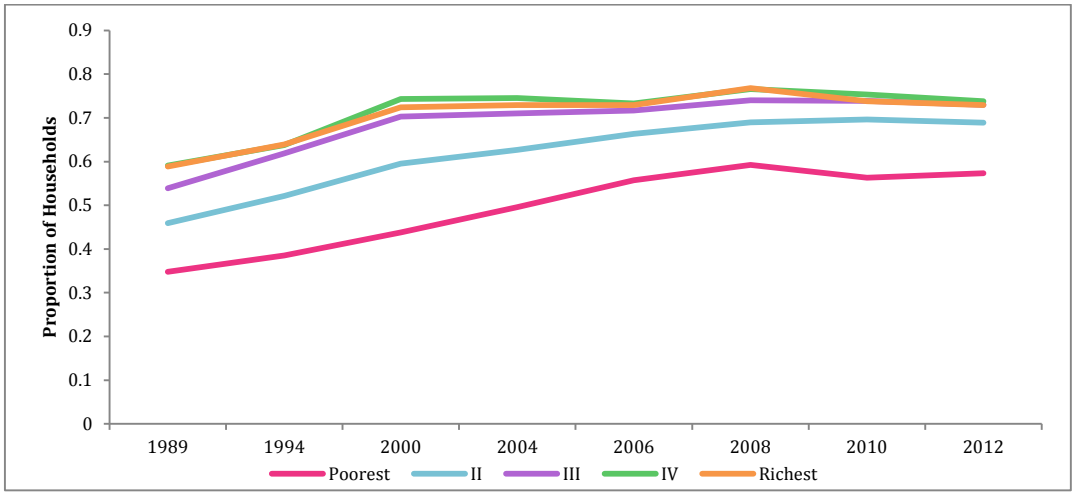
[93] An. R. 2016..

classified as energy-dense foods of low nutritional value: cookies, pastries, chocolates, candy, cake and jelly. Vegetables, fruits and bread were considered as possible substitute goods.

**Consumption Levels within the Mexican Population before the Fiscal Policy**

A closer look into the 1989-2012 period (Figure 10) indicates that although high-income families are consistently more likely to consume SSBs than low-income families, it is the low-income families (in quintiles I and II) that experienced the steepest increase in consumption over the years. After 2008 the trend changes, likely due to the financial and economic crisis of 2008. Indeed, since 2008, the percentage of households that consumed SSBs during the reference week stalled.

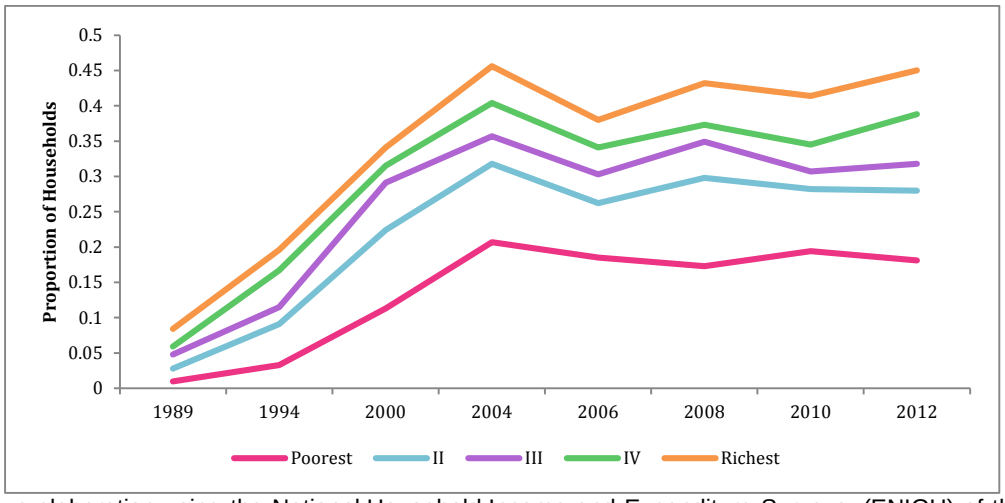
**Figure 10: Proportion of Households that Bought SSB during the Reference Week, by Income Quintiles. Mexico, 1989-2012**




Source: Own elaboration using the National Household Income and Expenditure Surveys (ENIGH) of the following years: 1989, 1994, 2000, 2004, 2006, 2008, 2010, and 2012.

The increase in SSB consumption across all population groups is evident when comparing it to the consumption of possible substitute goods like milk or water. Figure 5 (section III) shows that the proportion of families that purchased milk decreased during the period, while the consumption of SSBs experienced the opposite trend. From 2006 on, the proportion of families consuming SSBs during the reference week was greater than the proportion of households consuming milk and “ceteris paribus” (conditions remaining the same), the tendency suggests that this difference will continue to widen in the future. In the case of bottled water, the percentage of households that consumed bottled water remains more or less stable since 2004.

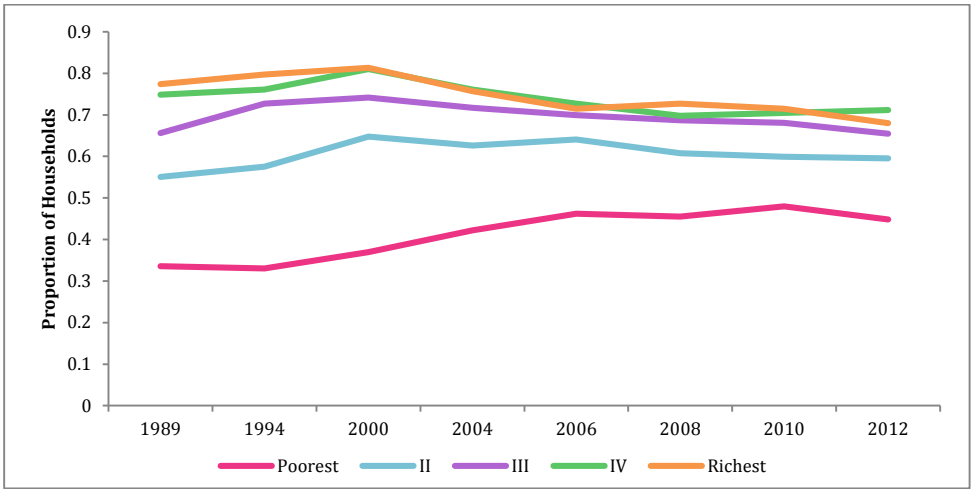
**Figure 11: Proportion of Households that bought Bottled Water during the Reference Week, by Income Quintile. Mexico, 1989-2012**




Source: Own elaboration using the National Household Income and Expenditure Surveys (ENIGH) of the following years: 1989, 1994, 2000, 2004, 2006, 2008, 2010, and 2012.

However, the patterns of consumption of milk and bottled water across income quintiles show different consumption patterns. Since 2006, the consumption of bottled water increased among households in the two richest quintiles of the income distribution, while its consumption stalled in the other quintiles (Figure 11). In the case of milk, households across all income quintiles except the poorest, decreased its consumption during the majority of the period analyzed (Figure 12). Milk consumption increased only among the poorest households, at least until the year 2010. Nevertheless, the poorest households consumed, on average, less milk and bottled water than the wealthier households.

**Figure 12: Proportion of Households that Bought Milk during the Reference Week, by Income Quintile. Mexico, 1989-2012**




Source: Own elaboration using the National Household Income and Expenditure Surveys (ENIGH) of the following years: 1989, 1994, 2000, 2004, 2006, 2008, 2010, and 2012.

**What Happened after the Implementation of the Taxes?**

A number of studies have been conducted on the impact of the taxes on consumption. However, the results of these studies are sometimes contradictory. One of the main studies conducted so far was led by a

team of researchers at the National Institute of Public Health jointly with the Carolina Population Center at the University of North Carolina, Chapel Hill. The researchers examined data –Nielsen Mexico Consumer Panel Services– on the purchases of the taxed products among households in 53 Mexican cities from January 2012 and December 2014. Results from the study, published in the British Medical Journal, show that purchases of taxed beverages decreased by an average of 6 percent and decreased at an increasing rate of up to a 12 percent decline a year after the taxes came into effect. The reductions were highest among the lower-SES households.[94]

The same team of researchers (Colchero et al. 2015 a) studied own and cross price elasticities of soft drinks and for all SSBs (fruit juices, fruit drinks, flavored water and energy drinks) and estimated expected direct and substitution reactions. They found unitary own price elasticities for soft drinks (-1.06) and SSBs (-1.16). The authors found that a price increase in all SSBs would be associated with a greater consumption of water, milk and a decrease consumption of candies, snacks and traditional snacks. They found higher elasticities among households living in rural areas (for soft drinks), in more marginalized areas and with lower income, so they expected that implementation of a tax to SSBs could decrease consumption particularly among the poor. They concluded that substitutions and complementarities with other food and beverages should be evaluated to assess the potential impact on total calories consumed.

Another study produced by researchers from the *Instituto Tecnológico Autónomo de México*, ITAM,[95] found little impact of the taxes on purchases and consumption.[96] The ITAM study looked at the effects of the taxes on the price, the consumption, and the estimated price elasticity of the taxed products. The measures used for the first two were total household calorie intake and the BMI of the household head one year before and one year after the taxes came into effect.

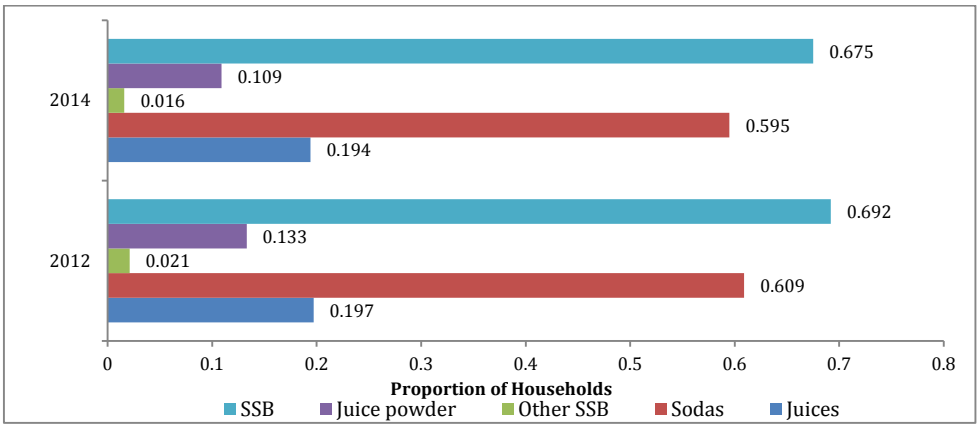
The study found that the taxed products are overall inelastic (price elasticity of SSBs was estimated to be -0.5) which if anything predicts high revenues resulting from the taxes. Regarding SSBs, the researchers found that the tax appeared to have incentivized moderate reduction in consumption of SSBs. The effect of the tax on SSBs appears to have had a greater effect among households in the higher income levels. As per the taxes on high-calorie foods, in order to control for potential product substitution resulting from the taxes, the researchers studied the total calories consumed (taxed and untaxed foods). They found a 1 percent decrease in calorie consumption per week. In their measures of BMI, the researchers found no discernible difference across the years under examination.

Finally, a study from Colmex on the impact of the taxes on SSBs finds that the own price elasticities of demand of sodas is lower than that of other beverages (i.e. juices, nectars, milk, and water) and that this price elasticity increases with the level of income of the household (-0.75 among the poorest, -0.92 for income strata 2, -1.01 for income strata 3, and -1.08 among the richest). This study though does not use individual data but consumer price data from INEGI and data on the global index of accumulated economic activity as a proxy for household available income.

The following paragraphs use data from the National Income and Expenditure Surveys to describe any discernable change in consumption of the taxed foods and beverages (and possible substitutes) bought and consumed within the households. As mentioned before, these data have limitations but they can provide some indications on the direction of changes brought about by the taxes, at least concerning consumption within households.

[94] Colchero M. A et al. 2016.
[95] This study received the support of the Mexican Consumer Industry Association ConMéxico.
[96] Arturo Aguilar., Emilio Gutierrez, Enrique Seira. 2016.

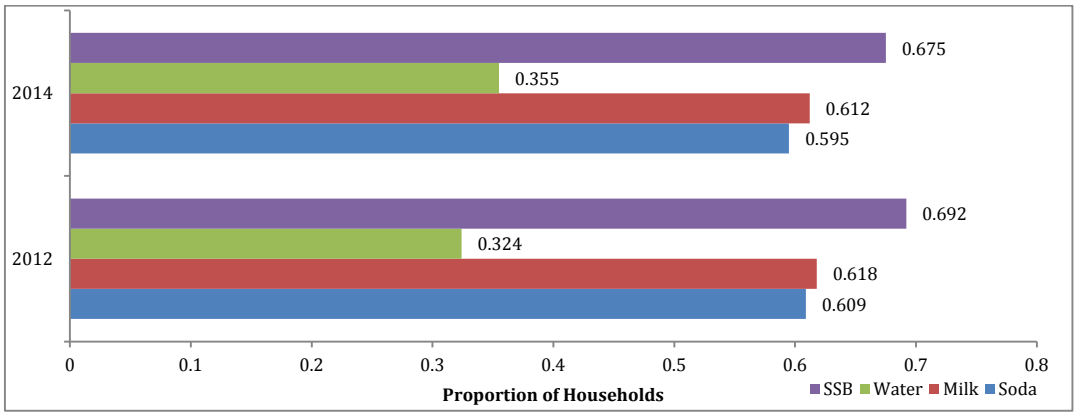
**Figure 13: Proportion of Households that Bought SSB during the Reference Week. Mexico, 2012-2014**




Source: Own elaboration using the National Household Income and Expenditure Surveys (ENIGH) of the following years: 2012 and 2014.

Between 2012 and 2014 there was a significant decrease in the proportion of households that purchased SSBs and a concurrent increase in the proportion of households that purchased water (Figure 13 and Figure 14). Overall, water consumption continued to grow at a constant rate during the two years (see Annex III for tables showing t-test for the statistical significance of all descriptive results shown in this section).

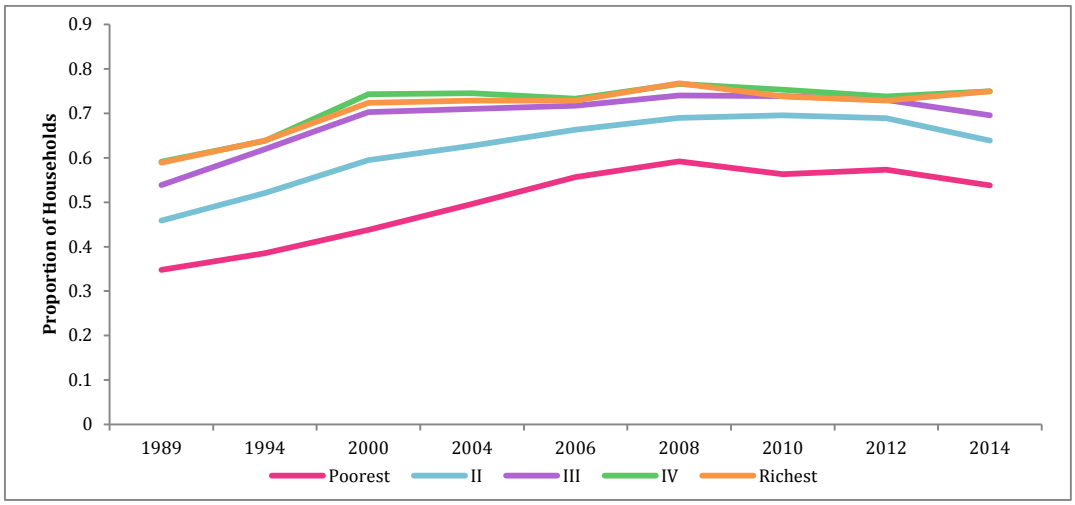
**Figure 14: Proportion of Households that bought SSB and Substitute Beverages during the Reference Week. Mexico, 2012-2014**




Source: Own elaboration using the National Household Income and Expenditure Surveys (ENIGH) of the following years: 2012 and 2014.

Figure 15 shows the trends in consumption of SSBs across income quintiles. Between 2012 and 2014 among the three poorest income quintiles, the percentage of households that reported consuming these beverages decreased. This contrasts with the previous increasing trends in the percentage of households buying SSBs in these quintiles, particularly until 2008. This was not the case among households in the richest quintile whose consumption slightly increased during this time frame (Annex III).

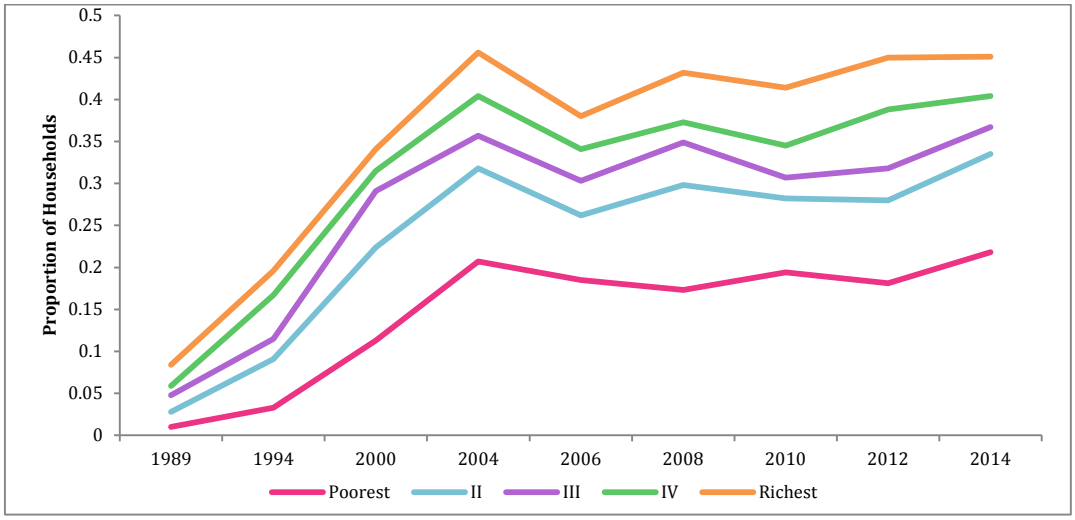
**Figure 15: Proportion of Households that Consumed SSBs during the Week of Reference Across Income Quintiles. Mexico 1989-2014.**




Source: Own elaboration using the National Household Income and Expenditure Surveys (ENIGH) of the following years: 1989, 1994, 2000, 2004, 2006, 2008, 2010, 2012, and 2014.

In contrast to the consumption pattern of SSBs, the consumption of bottled water increased, particularly among the poorest quintiles of the income distribution, which saw a sharp decrease in SSB consumption (Figure 16). This would also suggest a positive impact of the tax policy, since the population, at least those in the poorest end of the income distribution, substituted soda consumption – a calorie-dense product with no nutritional value – with water.

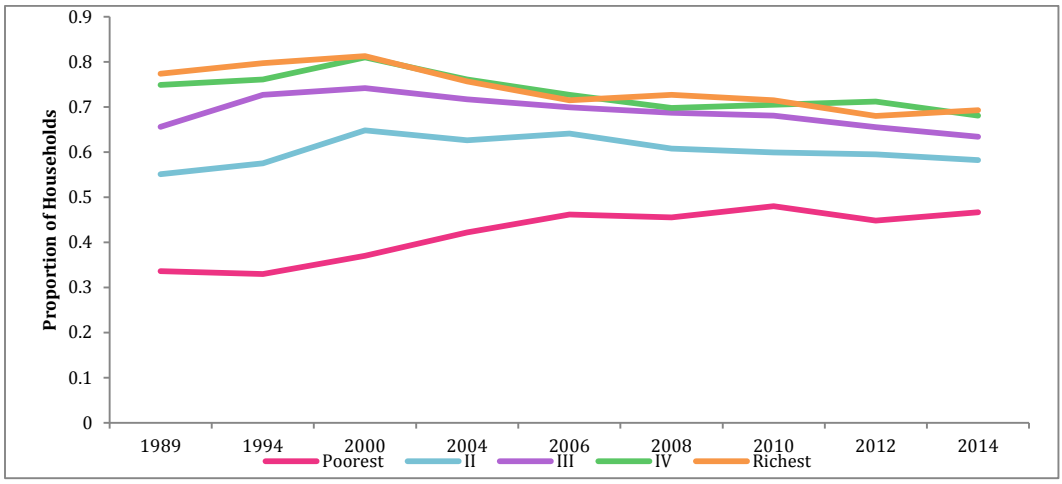
**Figure 16: Proportion of Households that bought Bottled Water during the Reference Week, by Income Quintile. Mexico, 1989-2014**




Source: Own elaboration using the National Household Income and Expenditure Surveys (ENIGH) of the following years: 1989, 1994, 2000, 2004, 2006, 2008, 2010, 2012, and 2014.

The proportion of households that purchased milk had been decreasing overall in Mexico since 2000. There was a slight increase between 2012 and 2014 only among households in the 1st quintile. A slight increase was also seen among households in the 5th quintiles but the increase was not statistically significant (Figure 17).

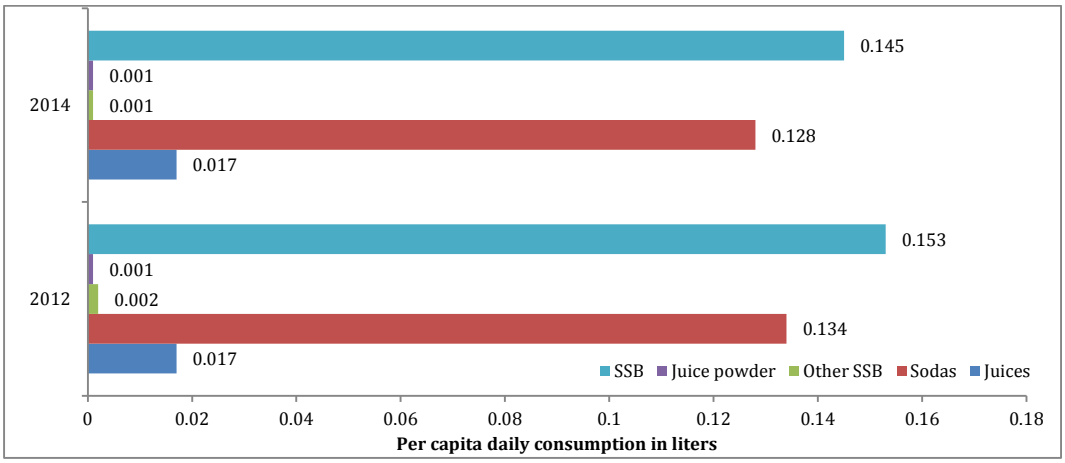
**Figure 17: Proportion of Households that bought Milk during the Reference Week, by Income Quintile. Mexico, 1989-2014**




Source: Own elaboration using the National Household Income and Expenditure Surveys (ENIGH) of the following years: 1989, 1994, 2000, 2004, 2006, 2008, 2010, 2012, and 2014.

Though per capita daily consumption of SSBs remained basically the same between 2010 and 2012, this changed afterwards. By 2014, daily per capita consumption of SSBs had decreased, especially due to a decrease in consumption of sodas.

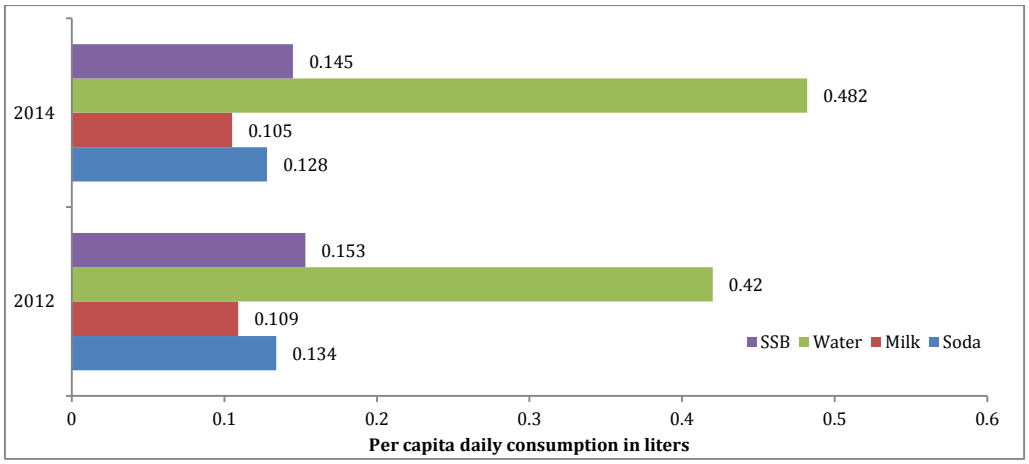
**Figure 18: Per capita Daily Consumption of SSB. Mexico, 2012-2014**




Source: Own elaboration using the National Household Income and Expenditure Surveys (ENIGH) of the following years: 2012 and 2014.

Per capita daily water consumption increased during that time frame. The small decrease in milk consumption was not statistically significant overall (see Annex III with t-tests for statistical significance).

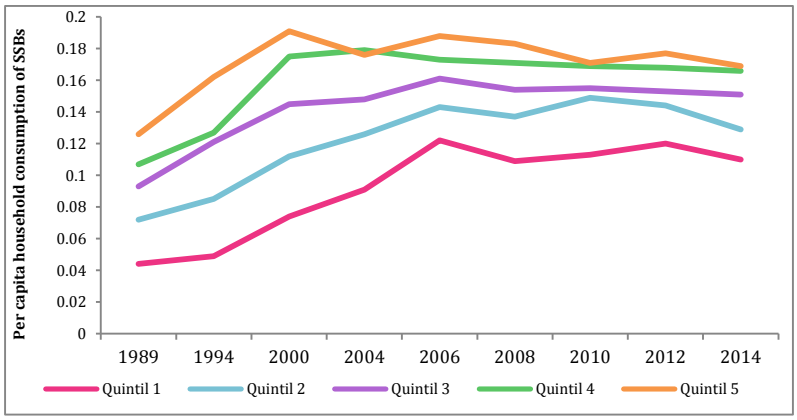
**Figure 19: Per capita daily Consumption of SSB and Substitute Goods. Mexico, 2012-2014**




Source: Own elaboration using the National Household Income and Expenditure Surveys (ENIGH) of the following years: 2012 and 2014.

These changes in consumption that occurred in 2014 after the taxes to SSBs were enacted varied across income quintiles. Figure 20 shows the trends in per capita consumption of SSBs in Mexico. As can be seen, between 1989 and 2006 there was a fast increase in per capita consumption, particularly among the poorest quintiles of the income distribution. Between 2006 and 2012, the trends in per capita consumption stalled. In 2014, per capita consumption of SSBs decreased among the poorest two quintiles and also among the richest quintile; remaining mostly the same among the other two quintiles (Figure 20).

**Figure 20: Per capita Consumption of SSBs in Mexico across Income Quintiles: 1989-2014**




Source: Own elaboration using the National Household Income and Expenditure Surveys (ENIGH) of the following years: 1989, 1994, 2000, 2004, 2006, 2008, 2010, 2012, and 2014.

Similarly, the poorest three quintiles experienced the largest increases in per capita water consumption in 2014; while the richest quintile decreased consumption and the fourth maintained it. In the case of milk, the first and third quintiles also slightly increased consumption, while households in the other quintiles continued the previous decreasing trends in consumption (Figure 21 and Figure 22).

**Figure 21: Mexico per capita Water Consumption per Income Quintile: 1989-2014**

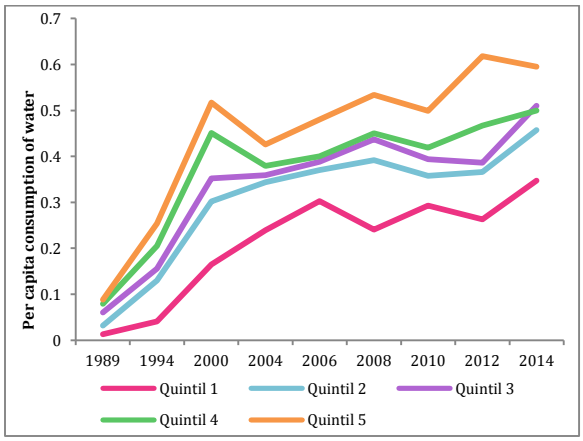
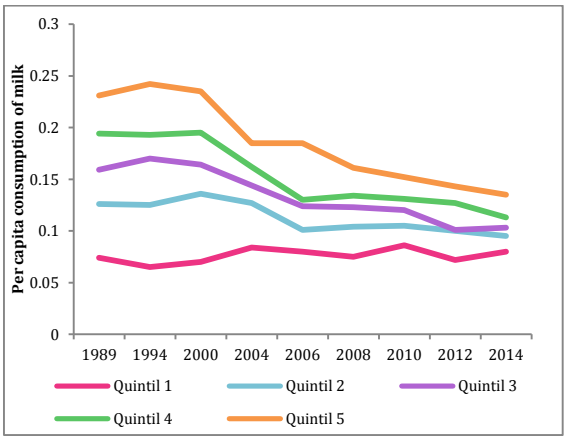


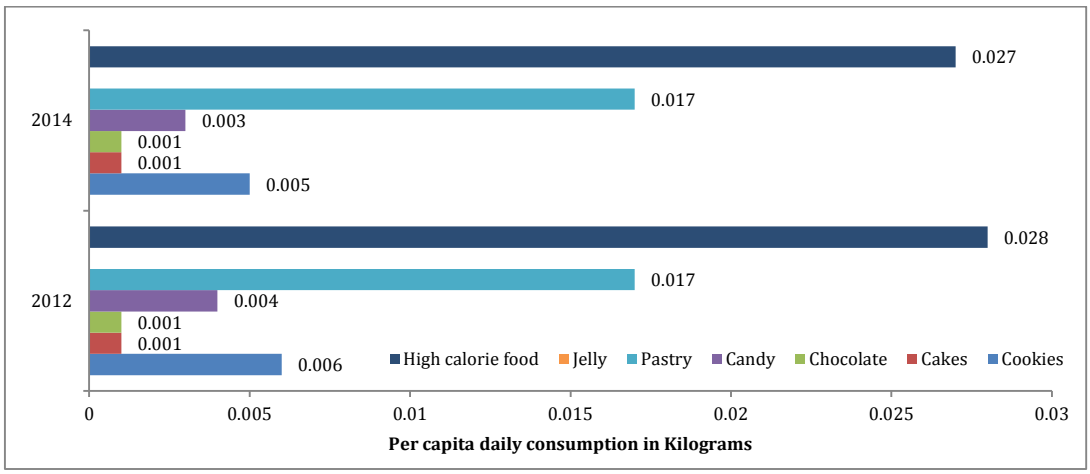

**Figure 22: Mexico per capita Milk Consumption per Income Quintile: 1989-2014**




Source: Own elaboration using the National Household Income and Expenditure Surveys (ENIGH) of the following years: 1989, 1994, 2000, 2004, 2006, 2008, 2010, 2012, and 2014.

In terms of consumption of foods of low nutritional value, with the exception of jelly, Mexican households purchased overall less high-calorie goods between 2012 and 2014. Products with high-calorie content such as candy, cakes and pastries were purchased at a lower frequency during this time frame (Figure 23). This represents a change in trends given the increase observed between 2010 and 2012.

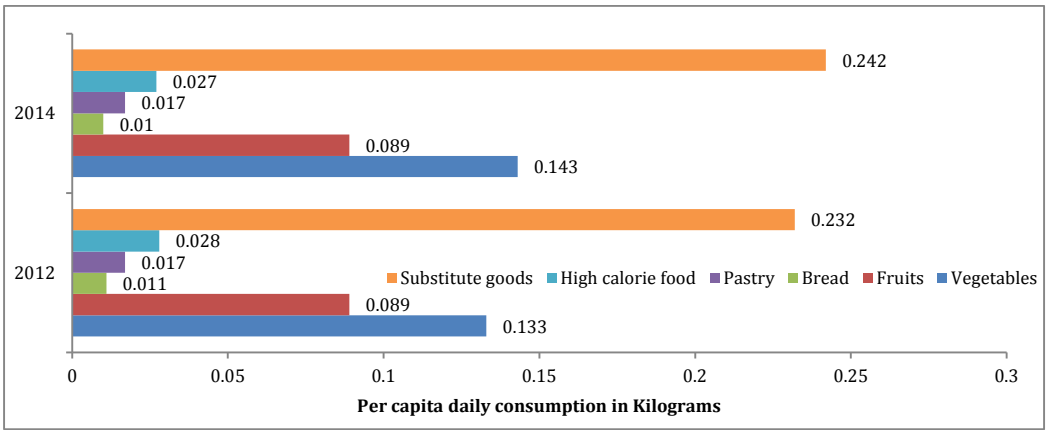
**Figure 23: Proportion of Households that Bought High Calorie Goods during the Reference Week. Mexico, 2012-2014**




Source: Own elaboration using the National Household Income and Expenditure Surveys (ENIGH) of the following years: 2012 and 2014.

At the same time, the proportion of households that purchased potential substitute goods such as fruits and vegetables increased significantly. Purchase of bread products stayed the same (Figure 24).

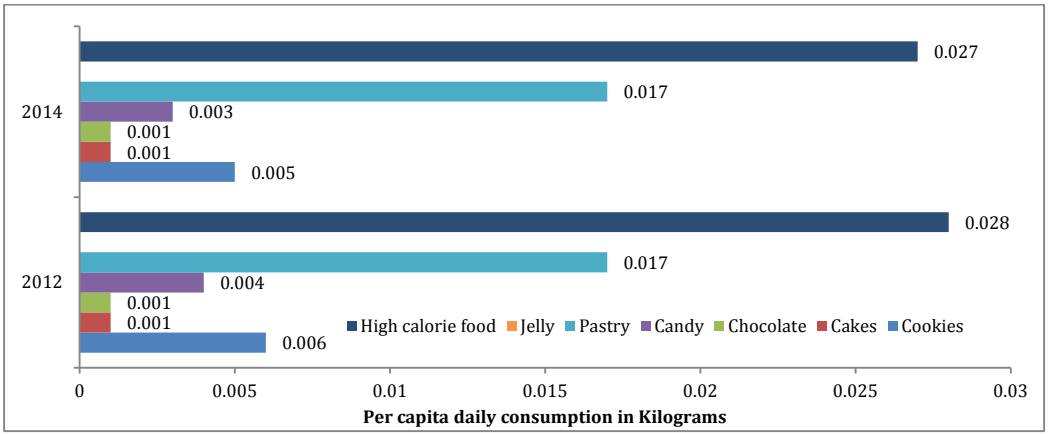
**Figure 24: Proportion of Households that Purchased High Calorie Goods and Substitute Goods during the Reference Week. Mexico, 2008-2014**




Source: Own elaboration using the National Household Income and Expenditure Surveys (ENIGH) of the following years: 2008, 2010, 2012, and 2014.

Per capita daily consumption of high-calorie foods saw a slight decrease between 2012 and 2014, mainly due to a decreased consumption of cookies and candies, but the decrease was not statistically significant. Instead, what was significant was an increase in the per capita daily consumption of fruits and vegetables.

**Figure 25: Per capita Daily Consumption of High Calorie Goods. Mexico, 2012-2014**




Source: Own elaboration using the National Household Income and Expenditure Surveys (ENIGH) of the following years: 2012 and 2014.

### Regression Results for the Demand of SSBs and Foods of Low Nutritional Value

Since the estimation of the demand for sodas and high-calorie foods using micro-data is censored, this analysis uses Heckman two-step estimation for the demand for sodas and high calorie foods following Parks and Capps (1997). This section first estimates the probability of households buying sweetened beverages/high calorie foods and in a second step estimates the demand for these two goods. In addition, the cross sectional household surveys used for this analysis provide information on expenditure in a food item and the quantity of the item; thus prices are estimated. These prices however are prices of a bundle of goods, they can varied in brand name, packaging or in other quality characteristics that are not observable. Thus to avoid a bias estimation, prices also need to be adjusted by quality. Following the work of Cox and Wohlgenant (1985), Park and Capps (1997), and Kuchler et al (2004), this section estimates the quality-adjusted prices (Annex IV describes the methodology used in detail).

The results of the quality adjusted price regressions are presented on Table 20 below. These regressions used data from the National Household Income and Expenditure Surveys of 2012 and 2014. The table indicates the variables that affect the price households pay for the goods subject to the taxes and some goods that might be substitutes to them such as milk, water, fruits and vegetables. Household size, income, characteristics of the household head, type of store where the items were bought and the location of the household have a significant effect on the prices paid and thus on the type of foods and beverages consumed.

**Table 20: Regression Results for Price/quality Functions for SSB, High Calorie Food and Complementary Products**

| | Dependent variable (price) | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | SSB | Sodas | Vegetables | Fruits | Milk | Water | High calorie food |
| Household Size | 2.651*** | -0.536*** | -0.582*** | -0.612*** | -0.243*** | -0.611*** | -1.091*** |
| | (0.386) | (0.041) | (0.103) | (0.130) | (0.034) | (0.073) | (0.327) |
| Household size squared | -0.128*** | 0.024*** | 0.034*** | 0.026** | 0.011*** | 0.036*** | 0.054** |
| | (0.027) | (0.004) | (0.008) | (0.011) | (0.003) | (0.006) | (0.027) |
| Income | -0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Income squared | 0.000*** | -0.000** | -0.000*** | -0.000*** | -0.000*** | -0.000*** | -0.000*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Age of household head | -0.153*** | 0.005*** | -0.004 | 0.002 | 0.004*** | -0.021*** | -0.038*** |
| | (0.019) | (0.001) | (0.004) | (0.005) | (0.001) | (0.003) | (0.012) |
| Item bought in tienda de abarrote (d) | -6.795*** | -0.563*** | 3.056*** | 0.058 | 0.665*** | 1.570*** | 2.490*** |
| | (0.642) | (0.050) | (0.133) | (0.145) | (0.041) | (0.099) | (0.352) |
| Married (d) | -1.492** | -0.417*** | 0.062 | -0.125 | 0.005 | -0.440*** | -1.030** |
| | (0.649) | (0.047) | (0.130) | (0.153) | (0.039) | (0.079) | (0.403) |
| Poverty (d) | 4.875*** | -0.068 | -0.279** | -0.536*** | -0.041 | 0.199** | -2.027*** |
| | (0.635) | (0.044) | (0.129) | (0.152) | (0.043) | (0.086) | (0.413) |
| Kids 6 years old or more(d) | -0.819 | -0.351*** | 0.174 | -0.229 | -0.025 | -0.123 | 0.966** |
| | (0.716) | (0.055) | (0.153) | (0.179) | (0.047) | (0.104) | (0.483) |
| Household head with secondary education or more (d) | -2.991*** | 0.132*** | 0.617*** | 0.653*** | 0.239*** | 0.047 | 2.169*** |
| | (0.661) | (0.043) | (0.121) | (0.136) | (0.037) | (0.078) | (0.374) |
| Rural (d) | -0.664 | 0.393*** | -0.560*** | -0.451*** | 0.442*** | 0.135 | -2.367*** |
| | (0.653) | (0.045) | (0.123) | (0.137) | (0.043) | (0.085) | (0.364) |
| Region=Noroeste (d) | 0.947 | 0.496*** | 0.155 | 0.151 | 0.297*** | -1.172*** | 0.526 |
| | (0.620) | (0.053) | (0.235) | (0.247) | (0.049) | (0.160) | (0.769) |
| Region=Occidente (d) | 1.078 | 0.149** | -2.603*** | -0.706*** | -1.796*** | -1.342*** | -6.747*** |
| | (0.849) | (0.065) | (0.243) | (0.263) | (0.057) | (0.164) | (0.745) |
| Region=Oriente (d) | 3.704*** | -0.315*** | -1.807*** | -1.163*** | -0.730*** | -1.387*** | -12.015*** |
| | (1.165) | (0.087) | (0.241) | (0.268) | (0.064) | (0.167) | (0.724) |
| Region=Centronorte (d) | 0.578 | -0.028 | -3.092*** | -0.997*** | -1.486*** | -0.244 | -7.369*** |
| | (0.739) | (0.060) | (0.236) | (0.248) | (0.056) | (0.201) | (0.704) |
| Region=CentroSur (d) | 3.728*** | -1.173*** | -2.462*** | -0.837*** | -0.136** | -1.222*** | -3.903*** |
| | (1.082) | (0.073) | (0.235) | (0.246) | (0.057) | (0.166) | (0.739) |
| Region=Sureste (d) | 6.650*** | -0.086 | 1.906*** | -0.108 | 0.325*** | -1.281*** | -7.103*** |
| | (0.815) | (0.056) | (0.252) | (0.281) | (0.088) | (0.157) | (0.704) |
| Region=Suroeste (d) | 6.138*** | 0.032 | -1.279*** | -0.019 | 0.598*** | -1.309*** | -15.900*** |
| | (1.502) | (0.078) | (0.253) | (0.287) | (0.078) | (0.176) | (0.755) |
| Constant | 27.823*** | 12.475*** | 20.374*** | 15.187*** | 12.780*** | 5.097*** | 61.134*** |
| | (1.523) | (0.133) | (0.386) | (0.465) | (0.114) | (0.299) | (1.225) |
| Observations | 57080 | 41481 | 116660 | 35407 | 38363 | 12990 | 39669 |
| R-squared | 0.021 | 0.126 | 0.026 | 0.054 | 0.135 | 0.167 | 0.081 |

Note: OLS. (d) indicates dummy variables. Standard errors in parentheses. "* p<0.1 ** p<0.05 *** p<0.01

Table 21 presents the regression results for the demands for foods and beverages subject to the taxes as well as some products that might behave as substitutes. As can be seen in the table, the own-price elasticity of demand for SSBs is negative, as expected, but inelastic. This might be due to the definition used for

SSBs in this study. As mentioned before, it was not possible to differentiate sodas, juices, concentrates and other flavored beverages from their counterparts with no added sugar, which are likely to be substitute beverages to the ones subject to the tax. Contrary to what was expected, the cross-price elasticities of demand of water and milk are not significant. The income elasticity of demand is positive, as expected, but also inelastic.

**Table 21: Regression Results for Product Demands**

| | Dependent Variables (ln [quantities]) | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | SSB | Sodas | High calorie food | Fruits | Vegetables | Water | Milk |
| **2nd Step** | | | | | | | |
| Ln(SSB price) | -0.292*** | | | | | -0.182*** | -0.077*** |
| | (0.032) | | | | | (0.065) | (0.025) |
| Ln(Milk price) | 0.035 | 0.307*** | | | | -0.125 | -0.609*** |
| | (0.101) | (0.118) | | | | (0.166) | (0.081) |
| Ln(Water price) | 0.036 | 0.116*** | | | | -1.088*** | -0.028 |
| | (0.046) | (0.039) | | | | (0.212) | (0.068) |
| Year=2014 (d) | -0.031 | 0.086*** | -0.010 | -0.092*** | -0.009 | -0.040 | -0.005 |
| | (0.060) | (0.033) | (0.034) | (0.022) | (0.014) | (0.083) | (0.077) |
| Ln (Soda price) | | -1.462*** | | | | 0.039 | 0.088 |
| | | (0.098) | | | | (0.084) | (0.107) |
| Ln (High calorie food) | | | -0.653*** | 0.095*** | -0.019 | | |
| | | | (0.035) | (0.027) | (0.030) | | |
| Ln(Vegetables) | | | 0.119*** | -0.017 | -0.244*** | | |
| | | | (0.023) | (0.044) | (0.036) | | |
| Ln(Fruits) | | | 0.152*** | -0.170*** | -0.009 | | |
| | | | (0.052) | (0.061) | (0.020) | | |
| Constant | 3.282*** | 4.651*** | 2.291*** | 2.099*** | 2.604*** | 7.114*** | 3.684*** |
| | (0.350) | (0.456) | (0.152) | (0.174) | (0.168) | (0.594) | (0.283) |
| **1st Step** | | | | | | | |
| Ln(income) | 0.317*** | 0.298*** | 0.165*** | 0.301*** | 0.073*** | 0.245*** | 0.371*** |
| | (0.060) | (0.073) | (0.026) | (0.033) | (0.013) | (0.060) | (0.056) |
| Meal planner= female (d) | 0.028 | 0.003 | 0.036 | 0.004 | 0.034 | -0.034* | 0.021 |
| | (0.043) | (0.072) | (0.022) | (0.019) | (0.028) | (0.019) | (0.036) |
| Meal planner age | -0.002** | -0.001 | 0.001 | 0.003** | 0.005*** | 0.003** | 0.000 |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.002) | (0.001) | (0.002) |
| Meal planner secondary education or more (d) | 0.125*** | 0.166*** | 0.125*** | 0.170*** | 0.087 | 0.128** | 0.253*** |
| | (0.034) | (0.060) | (0.037) | (0.045) | (0.057) | (0.053) | (0.046) |
| Meal planner works (d) | -0.049 | -0.047 | 0.050* | -0.074** | -0.110** | -0.067** | -0.087** |
| | (0.033) | (0.036) | (0.026) | (0.031) | (0.046) | (0.029) | (0.038) |
| Household has bicycle (d) | 0.081* | 0.015 | 0.116** | 0.016 | 0.094 | 0.011 | 0.029 |
| | (0.047) | (0.054) | (0.047) | (0.052) | (0.066) | (0.055) | (0.084) |
| Number of children in household (under 12) | 0.043** | 0.035 | 0.132*** | 0.050*** | 0.109*** | 0.031** | 0.071*** |
| | (0.022) | (0.021) | (0.015) | (0.009) | (0.023) | (0.012) | (0.026) |
| Number of people in household between 12 and 64 | 0.067*** | 0.102*** | 0.042*** | 0.030** | 0.223*** | 0.061*** | 0.051*** |
| | (0.025) | (0.030) | (0.009) | (0.014) | (0.039) | (0.016) | (0.017) |
| Number of people in the house 65 and more | -0.032 | -0.055 | 0.009 | 0.027 | 0.172*** | 0.002 | 0.011 |
| | (0.041) | (0.046) | (0.027) | (0.028) | (0.028) | (0.039) | (0.055) |
| Constant | -3.878*** | -4.070*** | -2.201*** | -3.610*** | -1.281*** | -3.806*** | -4.782*** |
| | (0.668) | (0.760) | (0.244) | (0.321) | (0.132) | (0.628) | (0.613) |
| Observations | 12882 | 14759 | 19369 | 22551 | 13444 | 22307 | 15177 |

Note: Heckman selection model. Inflation adjusted prices. (d) indicates dummy variables. We assume that the meal planner is the household head if it is a single headed household and the female of the household a two-headed household or household with a married head. Standard errors in parentheses. * p<0.1 ** p<0.05 *** p<0.01

Regarding the demographic variables used to explain variations in consumption, the higher the number of children and adults, the higher the number of beverages consumed; however, the number of older adults

in the family does not affect the quantities of SSBs consumed. The characteristics of the meal planner not always have the expected impact on consumption. For instance, while those meal planners that are currently employed tend to buy less SSBs; contrary to expectations, those with secondary education or more and younger meal planners tend to buy more SSBs than their less educated and older counterparts. Similarly, the ones that own a bicycle, used as a proxy for a health conscious meal planner, tend to buy more, not less SSBs.

In contrast to the sample of combined SSBs, when looking only at sodas (carbonated soft-drinks), the own-price elasticity of demand becomes elastic. Although in this case we could not either differentiate the diet or light versions from the regular sodas, the market for the low calorie products remains small in Mexico; thus this elasticity is likely to mainly reflect that of the regular versions of the sodas. In this case, the cross-price elasticities of demand of milk and water are positive and significant, indicating that when the prices of milk and water increase, the quantities of sodas also increase.

When looking at the demand equations for water and milk, both have negative own-price elasticities of demand. But contrary to what was expected, in the case of the demand for milk, the cross-price elasticity for SSBs is not significant and in the case of water it has a negative sign, indicating that water is a complement and not a substitute of SSBs. This again, could be the result of a not very precise definition of the SSBs used in this study. In the case of the cross-price elasticity for sodas only, all have the expected sign (positive, indicating consumption substitutes) but none are significant.

In the case of foods of low nutritional value subject to the 8 percent ad valorem tax, we can also observe that the own-price elasticity of demand is negative and inelastic. The definition used in this analysis as foods subject to this second tax is imprecise, including only those goods classified in the survey as: cookies, cakes, pastries, chocolates, jellies and candies. The cross-price elasticities of demand for fruits and vegetables are positive and significant, indicating that when the price of these foods increase, the quantities consumed of high calorie foods also increase. When looking at the demands for fruits and vegetables, only in the case of fruits, when the price of foods subject to the tax increase, there is a significant increase in the quantities of fruits consumed. In other words, fruits are substitute for foods of low nutritional value.

**Regression Results for the Demand of SSBs and Foods of Low Nutritional Value Across Income Quintiles**

To assess whether there is any differential impact of prices on consumption across socioeconomic levels, Table 22 presents the results of regressions for the demand of SSBs within each income quintile. In general, the own-price elasticity of demand decreases with income quintile, although it remains inelastic across the income distribution. The cross-price elasticities of milk is only significant among the poorest 20 percent of the population, confirming that among this group milk is a substitute product for SSBs. In the case of water, the cross-price elasticity of demand of SSBs is only significantly positive among the richest 20 percent of the population.

**Table 22: Regression Results for SSBs Across Income Quintiles**

| | SSB (ln [quantities]) | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| | Quintil 1 | Quintil 2 | Quintil 3 | Quintil 4 | Quintil 5 |
| **2nd Step** | | | | | |
| Ln(SSB price) | -0.707*** | -0.507*** | -0.127*** | -0.231*** | -0.285** |
| | (0.229) | (0.078) | (0.045) | (0.067) | (0.119) |
| Ln(Milk price) | 0.260* | 0.361 | -0.038 | -0.256 | 0.285 |
| | (0.146) | (0.295) | (0.226) | (0.307) | (0.243) |
| Ln(Water price) | 0.083 | -0.055 | 0.031 | 0.018 | 0.084* |
| | (0.079) | (0.105) | (0.076) | (0.033) | (0.051) |
| Year=2014 (d) | -0.142 | -0.131 | -0.057 | 0.074 | -0.005 |
| | (0.106) | (0.102) | (0.075) | (0.097) | (0.045) |
| Constant | 2.514*** | 1.390 | 3.203*** | 3.759*** | 2.392*** |
| | (0.858) | (0.874) | (0.709) | (0.965) | (0.554) |
| **1st Step** | | | | | |
| Ln(income) | 0.587*** | 0.897*** | 0.236 | 0.138 | 0.058 |
| | (0.075) | (0.276) | (0.166) | (0.145) | (0.055) |
| Meal planner= female (d) | -0.002 | -0.009 | 0.093 | -0.037 | -0.048 |
| | (0.113) | (0.107) | (0.081) | (0.056) | (0.074) |
| Meal planner age | -0.002 | -0.002 | -0.002 | -0.001 | -0.001 |
| | (0.003) | (0.002) | (0.002) | (0.001) | (0.002) |
| Meal planner secondary education or more (d) | 0.475*** | 0.262** | 0.097** | 0.015 | 0.059 |
| | (0.102) | (0.104) | (0.042) | (0.047) | (0.057) |
| Meal planner works (d) | -0.037 | -0.159*** | -0.002 | -0.026 | 0.024 |
| | (0.113) | (0.059) | (0.062) | (0.058) | (0.035) |
| Household has bicycle (d) | 0.183 | 0.062 | 0.127** | 0.012 | -0.130 |
| | (0.140) | (0.113) | (0.051) | (0.076) | (0.086) |
| Number of children in household (under 12) | -0.019 | 0.028 | 0.065*** | 0.048* | 0.112*** |
| | (0.053) | (0.030) | (0.015) | (0.026) | (0.030) |
| Number of people in household between 12 and 64 | -0.088** | -0.025 | 0.018 | 0.060*** | 0.142*** |
| | (0.041) | (0.036) | (0.024) | (0.019) | (0.025) |
| Number of people in the house 65 and more | -0.198** | -0.300*** | -0.024 | -0.092*** | 0.025 |
| | (0.084) | (0.075) | (0.054) | (0.030) | (0.080) |
| Constant | -6.322*** | -9.264*** | -2.952* | -1.731 | -1.187 |
| | (0.568) | (2.554) | (1.741) | (1.571) | (0.724) |
| Observations | 3052 | 2541 | 2459 | 2369 | 2461 |

Note: Heckman selection model. Inflation adjusted prices. (d) indicates dummy variables. We assume that the meal planner is the household head if it is a single headed household and the female of the household a two-headed household or household with a married head. Standard errors in parentheses. *p<0.1 **p<0.05 ***p<0.01

When looking at sodas only, the own-price elasticity of demand of sodas is elastic in all income quintiles, but it is the third quintile the one with the highest elasticity of demand. When looking at the cross-price elasticities of demand, the table shows that when the price of water increases, the quantity consumed of sodas increases for households at the two extreme of the income distribution (quintiles 1 and 5). Similarly, when the price of milk increases the quantity consumed of sodas increases significantly for quintiles 2 and 5.

**Table 23: Regression Results for the Demand of Sodas Across Income Quintiles**

| | Sodas (ln [quantities]) | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| | Quintil 1 | Quintil 2 | Quintil 3 | Quintil 4 | Quintil 5 |
| **2nd Step** | | | | | |
| Ln(Soda price) | -1.090*** | -1.501*** | -1.719*** | -1.384*** | -1.433*** |
| | (0.319) | (0.234) | (0.198) | (0.209) | (0.124) |
| Ln(Milk price) | 0.323 | 0.637*** | 0.135 | 0.097 | 0.494* |
| | (0.248) | (0.232) | (0.198) | (0.185) | (0.268) |
| Ln(Water price) | 0.306*** | -0.006 | 0.052 | 0.078 | 0.152*** |
| | (0.100) | (0.082) | (0.094) | (0.062) | (0.050) |
| Year=2014 (d) | -0.053 | 0.067 | 0.201*** | 0.084 | 0.076** |
| | (0.124) | (0.074) | (0.074) | (0.073) | (0.037) |
| Constant | 2.467** | 3.289*** | 5.769*** | 5.169*** | 4.113*** |
| | (1.167) | (0.673) | (0.884) | (0.759) | (0.707) |
| **1st Step** | | | | | |
| Ln(income) | 0.562*** | 0.940*** | 0.588** | 0.221 | -0.155*** |
| | (0.100) | (0.341) | (0.273) | (0.195) | (0.034) |
| Meal planner= female (d) | 0.097 | -0.066 | 0.134 | 0.024 | -0.128 |
| | (0.134) | (0.137) | (0.127) | (0.080) | (0.099) |
| Meal planner age | -0.001 | 0.000 | -0.001 | 0.000 | 0.000 |
| | (0.003) | (0.002) | (0.003) | (0.001) | (0.002) |
| Meal planner secondary education or more (d) | 0.441*** | 0.255*** | 0.101 | 0.088 | 0.110 |
| | (0.121) | (0.074) | (0.071) | (0.059) | (0.099) |
| Meal planner works (d) | -0.034 | -0.124** | -0.070 | -0.068 | 0.058 |
| | (0.104) | (0.060) | (0.120) | (0.061) | (0.050) |
| Household has bicycle (d) | 0.118 | -0.038 | 0.087 | 0.004 | -0.117 |
| | (0.143) | (0.085) | (0.128) | (0.098) | (0.116) |
| Number of kid in household (under 12) | -0.048 | 0.017 | 0.057* | 0.030 | 0.083** |
| | (0.044) | (0.038) | (0.034) | (0.026) | (0.035) |
| Number of people in household between 12 and 64 | -0.085* | -0.005 | 0.028 | 0.092*** | 0.184*** |
| | (0.049) | (0.037) | (0.029) | (0.026) | (0.033) |
| Number of people in the house 65 and more | -0.207*** | -0.288*** | -0.069 | -0.107** | 0.018 |
| | (0.077) | (0.075) | (0.122) | (0.050) | (0.081) |
| Constant | -6.388*** | -9.984*** | -6.828** | -3.085 | 0.788* |
| | (0.889) | (3.242) | (2.793) | (2.048) | (0.458) |
| Observations | 3566 | 3006 | 2797 | 2681 | 2709 |

Note: Heckman selection model. Inflation adjusted prices. (d) indicates dummy variables. We assume that the meal planner is the household head if it is a single headed household and the female of the household a two-headed household or household with a married head. Standard errors in parentheses. *p<0.1 **p<0.05 ***p<0.01

Similar to the case of SSBs, the own-price elasticity of demand of foods subject to the 8 percent ad valorem tax also decrease with income quintile. The demand of the poorest end of the income distribution is more elastic to the changes in prices of these goods (Table 24).

**Table 24: Regression Results for the Demand of High Calorie Foods Across Income Quintiles**

| | High calorie food (ln [quantities]) | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| | Quintil 1 | Quintil 2 | Quintil 3 | Quintil 4 | Quintil 5 |
| **2nd Step** | | | | | |
| Ln(High calorie food price) | -0.930*** | -0.638*** | -0.686*** | -0.594*** | -0.586*** |
| | (0.143) | (0.081) | (0.060) | (0.045) | (0.084) |
| Ln(Vegetables price) | 0.141 | -0.058 | 0.212** | 0.089 | 0.188*** |
| | (0.090) | (0.114) | (0.098) | (0.065) | (0.072) |
| Ln(Fruits price) | 0.140 | 0.353*** | 0.129* | 0.120 | 0.095 |
| | (0.090) | (0.077) | (0.067) | (0.074) | (0.064) |
| Year=2014 (d) | 0.095 | 0.020 | 0.010 | -0.033 | -0.087 |
| | (0.062) | (0.046) | (0.074) | (0.038) | (0.053) |
| Constant | 3.306*** | 1.820*** | 2.129*** | 2.203*** | 2.174*** |
| | (0.501) | (0.493) | (0.482) | (0.303) | (0.424) |
| **1st Step** | | | | | |
| Ln(income) | 0.221** | 0.395 | 0.081 | 0.083 | 0.107** |
| | (0.087) | (0.273) | (0.154) | (0.204) | (0.049) |
| Meal planner= female (d) | 0.011 | 0.145* | 0.287*** | -0.046 | -0.208*** |
| | (0.072) | (0.081) | (0.090) | (0.107) | (0.034) |
| Meal planner age | 0.001 | -0.001 | -0.002 | 0.003** | 0.003 |
| | (0.002) | (0.001) | (0.002) | (0.001) | (0.002) |
| Meal planner secondary education or more (d) | 0.201* | 0.094** | 0.109** | 0.096** | 0.177** |
| | (0.119) | (0.041) | (0.043) | (0.038) | (0.081) |
| Meal planner works (d) | 0.100* | 0.081 | 0.078 | 0.054 | -0.015 |
| | (0.057) | (0.098) | (0.048) | (0.034) | (0.040) |
| Household has bicycle (d) | 0.073 | 0.080 | 0.214** | 0.105 | 0.081* |
| | (0.085) | (0.074) | (0.089) | (0.107) | (0.042) |
| Number of kid in household (under 12) | 0.168*** | 0.165*** | 0.109*** | 0.107*** | 0.104*** |
| | (0.032) | (0.027) | (0.034) | (0.007) | (0.036) |
| Number of people in household between 12 and 64 | 0.032 | -0.001 | 0.018 | 0.034* | 0.064*** |
| | (0.022) | (0.033) | (0.029) | (0.019) | (0.012) |
| Number of people in the house 65 and more | 0.014 | -0.124** | 0.037 | -0.004 | 0.075 |
| | (0.078) | (0.055) | (0.043) | (0.036) | (0.052) |
| Constant | -2.821*** | -4.297 | -1.368 | -1.224 | -1.597*** |
| | (0.738) | (2.616) | (1.565) | (2.144) | (0.543) |
| Observations | 3902 | 3876 | 3825 | 3877 | 3889 |

Note: Heckman selection model. Inflation adjusted prices. (d) indicates dummy variables. We assume that the meal planner is the household head if it is a single headed household and the female of the household a two-headed household or household with a married head. Standard errors in parentheses. * p<0.1 ** p<0.05 *** p<0.01

# VII. CONCLUSIONS

Faced with a large and increasing obesity epidemic, the Mexican Government in the last years has increased efforts in the prevention and control of obesity. Among these efforts, in October 2013, Mexico's Congress passed legislation imposing taxes on SSBs and calorie-dense foods of low nutritional value. This fiscal reform was discussed in the early days of the current Government administration, which ensured a higher probability of enactment. Specifically, both taxes were part of a reform of the Law on the Special Tax on Production and Services (*Impuesto Especial sobre Productos y Servicios* -IEPS).

These taxes were not enacted in isolation, but were part of a comprehensive strategy to prevent and control obesity, overweight and diabetes. In addition to fiscal policy and regulation, this strategy included other health promotion and prevention interventions as well as measures to ensure better access to effective health care services.

There were several reasons behind the Mexican Government decision to enact fiscal policies to contribute to the prevention and control obesity. First, the food and beverages subject to these taxes are calorie-dense but do not provide much nutritional value. There is increasing evidence linking their consumption with an increasing trend in overweight, obesity and other chronic conditions. The consumption of these foods and beverages have been growing fast in previous years. Indeed, Mexico is one of the countries in the world with the highest consumption of SSBs. Finally, there is limited but increasing evidence showing that these taxes can decrease consumption and improve health outcomes.

The process that resulted in the enactment of these taxes was a long and challenging one. The discussions to develop taxes on SSBs and low nutritional value foods started years before 2013 as part of an overall discussion in the country of what was needed to stop, and if possible revert, the increasing trend of adults and children overweight and obese. The success of this effort was not due to a single stakeholder within the executive or legislative branch of Government. It was the collective and persistent efforts of several civil society organizations that for a long time lobbied for the inclusion of these taxes and implemented a strong communication campaign. This effort would also not have been possible without the academic grounding and evidence generated by the National Institute of Public Health and others such as the National Institute of Medical Sciences. The actors favoring this policy had to counteract much opposition from strong stakeholders, including food and beverage industry, bottling companies, and others. The latter also implemented a large media campaign opposing these taxes. Even after the enactment of the taxes, this opposition has continued and it almost resulted in a partial reversal of the policy in 2015.

The design of the taxes on SSBs and foods of low nutritional value is complex. Not only do policymakers have to ensure that the taxes are passed to the prices of the goods under consideration, but also ensure that this increase in prices results in a decrease in consumption of the foods and beverages taxed and does not increase consumption of other unhealthy foods and beverages that are not subject to taxation. In Mexico, several of these issues were taken into account in the design of the fiscal policy. For instance, the tax to SSBs included all beverages with added sugar; this would include not just sodas but also juices and concentrates with added sugar. It also included a broad definition of sugar to include, among others, table sugar as well as high-fructose corn syrup[97]. In addition, to avoid substitution of sugary-drinks with sugary-foods, there were taxes not just to SSBs, but also to foods of low nutritional value, which include foods with added sugar.

These taxes have been successful in increasing fiscal revenues. They have also been successful in increasing the price of the products taxed. There is also evidence that they produced a decrease in consumption, particularly of SSBs. However, there is still a debate about how large this impact was and whether there is an impact on health outcomes.

A review of the studies conducted so far on the impact of the reform on prices, including our analysis, highlight the following: (i) the prices of soda drinks tended to increase by the amount of the tax or more;

[97] PRODECON. 2013.

(ii) prices of smaller packages of the taxed products increased more than 1 peso per liter and larger packages increased around 1 peso; (iii) other SSBs (flavored waters and industrialized juices) increased by less than 1 peso; (iv) it is not clear whether diet soda prices were affected by the tax; and (v) there were regional differences on price setting.

When comparing the prices of SSBs in Mexico after the tax reform with comparison countries like Argentina and Brazil, the prices in Mexico remain relatively low, which make these goods more affordable in Mexico than in Argentina or Brazil. This suggests there may be additional room to increase prices and possibly achieve a larger impact on reducing consumption.

Our own analysis of the price structure of SSBs in Mexico before and after the tax shows that the price differences between competing brands (that is, among cola soft-drinks) and types of sodas (between cola and flavored sodas) were high before the fiscal policy was enacted, and that the tax increase was not large enough to move the entire price structure up. It was reasonable to expect that consumers could purchase cheaper versions of the taxed product at almost pre-tax levels. For example, in December 2013, before the taxes came into effect, the 2 liter Coke bottle was on average MXN 19.5 while that of Pepsi was MXN 15.6. Also, the price of the 2 liter Fanta bottle was almost 4 pesos cheaper than that of Coke. In December 2015, two years after the reform, the 2 liter Pepsi bottle was MXN 19.8, similar to the price of the 2 liter Coke bottle before the reform, while the 2 liter Fanta bottle was cheaper (about MXN 18).

In addition, before the reform, the liter of the cheapest presentation of Coke averaged MXN 9.3 to the Mexican consumer. After more than two years of the reform, it is possible to buy, through large sale promotions, one liter of cola and flavored sodas by MXN 4.4 in the Mexican supermarkets. For those consumers able to buy at these sale promotion prices, the tax reform has not drastically changed the financial incentives to reduce the consumption of regular sodas.

In terms of volumes purchased, existing studies, for instance Colchero et al. (2016) found that the post-tax purchases of SSBs during the first year were 6 percent lower on average than the pre-tax trend. They also found that purchases of untaxed beverages (mainly bottled water) were 4 percent higher. They found that the reduction in purchases of non-carbonated taxed beverages was larger than the reduction in carbonated taxed beverages. This could be due to higher prices and high price elasticities of non-carbonated beverages; and consumers shifting to lower priced versions of taxed carbonated beverages given the large variation in prices. They also found that the largest impact on consumption was among households of low socioeconomic level.

Another study published by ITAM (Aguilar et al., 2016) found that the tax appeared to have incentivized moderate reductions in consumption of SSBs. The effect of the tax on SSBs, contrary to what was found by the previous study, appears to have had a greater effect among households in the higher income level. As per the taxes on high-calorie foods, in order to control for potential product substitution resulting from the taxes, the researchers studied the total calories consumed (taxed and untaxed foods). They found a weekly decrease in calorie consumption of 1 percent. In their measures of BMI, the researchers found no discernible difference across the years under examination, which is in line with the small impact seen for calories consumed.

Our analysis also used a series of the National Household Income and Expenditure surveys to observe the behavior of consumption before and after the tax. These data have limitations to study the impact of the taxes; however, they can provide some insight on the possible direction of the changes and who could have been more affected by the tax.

The descriptive analysis of the data shows a reduction in the percentage of households that purchased and consumed SSBs within the household between 2012 and 2014; this is particularly the case among households in the poorest income quintiles. It also showed a significant increase in the percentage of households that purchased bottled water and, among the poorest 20 percent of households, there was also a significant increase in the percentage of families that bought milk. The data also shows a significant decrease in the per capita consumption of SSBs and an increase in per capita consumption of bottled water, particularly among the three poorest quintiles of the income distribution.

Regarding the second tax, the percentage of households that purchased energy-dense foods of low nutritional value, such as cookies, jellies and candies slightly decreased from 2012 to 2014. The decrease in per capita consumption however was not statistically significant.

Regression analysis of the demand for foods and beverages subject to the taxes show that the own-price elasticity of demand of SSBs is inelastic. This could be due to the imprecise definition for SSBs used in this study since it was not possible to distinguish sodas, juices and other flavored beverages with and without added sugars. However, when we look at the demand of sodas, which are more likely to have added sugar (the market for light or low calorie versions is small in Mexico), the own-price elasticity of demand becomes elastic. Across income quintiles, the own-price elasticity of demand of SSBs decreases with income quintile; while the own-price elasticity of demand of sodas is highest among people in the middle of the income distribution.

People in the poorest end of the income distribution seem to have had the largest changes in consumption. They have the largest price elasticity of demand of SSBs and thus any price increase would result in a larger decrease in consumption than among people in the highest end of the income distribution. The poorest also seem to have had the largest increase in water consumption. Similarly for the case of high-calorie dense foods, the poorest seem to have had the largest decrease in consumption. Thus in principle, they should also have the largest improvements in health outcomes, although this is something that would need to be confirmed. These results across income quintiles are similar to those found by a study from a team from the National Institute of Public Health but different from those of a study from ITAM and another from Colmex, although this latter one does not use individual data.

It is important to continuously monitor the reduction in consumption and consumption substitution (to healthy or unhealthy substitutes). Fiscal policy used for health promotion purposes is still a controversial issue. These reforms face major risks. They tend to affect a relatively small group of powerful and concentrated businesses with the capacity to fight back. In addition, if the tax is small and there is potential for consumption substitution within the taxed products (that is, cheaper brands, cheaper packages within the same brand, or through promotions) the impact of the tax on the consumption of the unhealthy good could be small. Policymakers should then be aware of the possible resistance and producers' and consumers' strategies that could reduce the expected impact of the tax. Thus the need to monitor on a continued basis the impact on prices and consumption, which is possible to do through the development of price and volume indicators based on publicly available data as was shown in this document. These indicators are important and easy-to-generate tools for the political debate about effectiveness of the reform design and implementation. Although to make these indicators more effective, there is also a need to improve the publicly available data that INEGI collects on prices and volumes of sales.

There are still several questions that have not been fully addressed related to the impact of these taxes. The first one is whether the tax has an impact on health outcomes; in other words, whether it will decrease BMI. A perceptible impact on BMI might take time to be achieved and it is not clear if the available data will allow this type of impact to be assessed. Related to this, there is also an issue of whether there is a different long term impact of these taxes. For instance, the taxes could lead to a reformulation of the goods taxed or might change the norm of what is considered healthy. This could result in a higher impact of the taxes in the long term.

Finally, since the impact of this fiscal policy on health outcomes is the expected result from a public health stand point, it is key to also monitor the health impact of this and other policies included in the National Strategy for the Prevention and Control of Overweight, Obesity and Diabetes on a continuous basis. Thus the need to monitor closely not only prices and volumes of the goods subject to taxation, but also BMI across gender and age groups. However, there is no readily available data to do this on a country level, beyond the data collected every six years in the ENSANUT surveys and thus there is a need to generate this information on a more continuous basis.

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# VIII. ANNEXES

**Annex I: Average Price Definitions and Values of Foods and Beverages Subject to the Taxes**

**Table I.1 a: Average Prices of Taxed and Potential Substituted Products – Definitions Calorie-dense Foods of Low Nutritional Value**

| Article 2 , Fraction I, Incise J of the Special Tax on Production and Services (IEPS) | Name of the Product | Source | Subgroups of products included in definition |
|---|---|---|---|
| **Snacks** | Snacks Foods (average of the whole family) | Average Prices | Potato Chips include potato chips and peanuts, but not pork rinds |
| | Potato Chips | Average Prices | Other Foods /Chocolates and Candies/ Potato Chips/ Specification: Potato Chips |
| | Corn Fritters | | Other Foods /Chocolates and Candies/ Potato Chips/ Specification: Corn Fritters |
| **Candy Store Products** | Fruit Popsicles | Averages Prices | Other Foods/ Chocolates and Candies /Candies and Goat Milk Caramel/Specification: Fruit popsicles |
| | Goat Milk Caramel | | Other Foods/ Chocolates and Candies /Candies and Goat Milk Caramel/Specification: Goat Milk Caramel |
| **Fruit and Vegetable Sweets** | Fruit and Vegetable Jams | Average Prices | Fruit and Vegetables/Fruits and Processed Vegetables/Other Fruit Preserves/Specification: Jams |
| **Caramel** | Caramel | Averages Prices | Other Foods/ Chocolates and Candies /Candies and Goat Milk Caramel/Specification: Caramel |
| **Sugary Cereals** | Sweet Corn Flakes | Average Prices | Bread, Tortillas and Cereals/Rice and Prepared Cereals/Corn Flakes /Specification: Corn Flakes |
| **Cookies** | Cookies | Average Prices | Bread, Tortilla and Cereals/Biscuits, Pastas and Wheat Flour/Biscuits /Specification: Sweet |
| **Sweet Bread** | Sweet bread (in bulk) | Average Prices | Bread, Tortilla and Cereals/Bread/Specification: Sweet Bread |
| | Industrialized Sweet bread | Average Prices | Bread, Tortilla and Cereals/Cakes, Muffins and Packed Sweet Bread/Specification: Sweet Bread |
| **Cakes and Muffins** | Pancakes, Cakes and Pastries | Average Prices | Bread, Tortilla and Cereals/Cakes, Muffins and Packed Sweet Bread/Specification: Muffins |

Source: INEGI – Average Prices

**Table I.1 b: Average Prices of Taxed and Potential Substituted Products – Definitions Sugar-Sweetened Beverages**

| Article 2 , Fraction I, Incise G of the Special Tax on Production and Services (IEPS) | Name of the Product | Source | Subgroup of products included in the definition |
|---|---|---|---|
| **Sugar Sweetened Beverages** | Juices and Fruit Nectars | Average Prices | Fruits and Vegetables/Processed fruits and Vegetables/Bottled Juices or Nectars/Specification: the entire group |
| | Soft Drinks Concentrates | Average Prices | Other Foods/Chocolates and Candies/Soft Drinks concentrate/Specification: in bottle |
| | Orange Juice Concentrates | Average Prices | Other Foods/Chocolates and Candies/Soft Drinks Concentrate/Specification: Powder |
| | Flavored Powder Drink Mix | Average Prices | Other Foods/Chocolates and Candies/Soft Drinks Concentrate/Specification: Powder |
| | Cola sodas | Average Prices | Sugar, Coffee and soft drinks/Bottled Soft Drinks/Specification: Cola |
| | Flavored Sodas | Average Prices | Sugar, Coffee and soft drinks/Bottled Soft Drinks/Specification: Flavored |
| | Flavored Waters | Average Prices | Sugar, Coffee and Soft Drinks/Bottled Water/Specification: flavored |
| | Energy or sport drinks | Average Prices | n.d |
| **Substitutes** | **Name of the Product** | **Source** | **Subgroup of products included** |
| **Potential Substitutes** | Light Cola Soda | Average Prices | Sugar, Coffee and soft drinks/Bottled Soft Drinks/Specification: Light |
| | Bottled Water | Average Prices | Sugar, Coffee and Soft Drinks/Bottled Water/Specification: bottle |
| | Whole Milk | Average Prices | Milk, Milk Products and Eggs/Pasteurized and Fresh Milk/Specification: Whole Milk |
| | Skimmed milk | Average Prices | Milk, Milk Products and Eggs/Pasteurized and Fresh Milk/Specification: Light Milk |
| | Yoghourt | Average Prices | Milk, Milk Products and Eggs/Milk Products/Yoghurt/Specification: natural |
| | Yoghourt in varied forms | Average Prices | Milk, Milk Products and Eggs/Milk Products/Yoghurt/Specification: Fruits |
| | Whole Powder Milk | Average Prices | Milk, Milk Products and Eggs/Processed Milk /Powder Milk/Specification: Whole |
| | Skimmed Powder Milk | Average Prices | Milk, Milk Products and Eggs/Processed Milk /Powder Milk/Specification: Skimmed |
| | Whole wheat bread | Average Prices | Bread, Tortilla and Cereals/Packed Bread/Specification: Whole Grain |
| | Standard sugar production | Average Prices | Sugar, Coffee and Soft Drinks/Sugar/Specification: Standard |
| | Refined sugar production | Average Prices | Sugar, Coffee and Soft Drinks/Sugar/Specification: Refined |
| | Fresh fruit | Average Prices | Foods/Fruits and Vegetables/ Fresh Fruits |

Source: INEGI – Average Prices

**Table I.1c: Average Prices – Annual Values**

| Product Definition | Units | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|
| Snacks (average of the whole family) | KG | 127.5 | 135.9 | 144.8 | 160.0 | 166.7 |
| Potato Chips | KG | 145.3 | 153.8 | 165.0 | 184.2 | 193.6 |
| Corn Fritters | KG | 101.9 | 108.3 | 112.6 | 129.8 | 133.6 |
| Fruit Popsicle | KG | 77.8 | 88.6 | 95.7 | 117.2 | 120.3 |
| Goat milk caramel | KG | 76.1 | 80.9 | 79.7 | 87.0 | 89.6 |
| Fruit and Vegetable Jams | KG | 45.1 | 48.0 | 50.1 | 51.3 | 52.3 |
| Caramel | KG | 60.0 | 65.0 | 68.5 | 71.6 | 74.4 |
| Corn flakes with Sugar | KG | 56.3 | 61.7 | 63.0 | 67.5 | 66.7 |
| Cookies | KG | 63.7 | 65.9 | 69.6 | 78.2 | 83.4 |
| Sweet Bread (in bulk) | PZA | 4.1 | 4.5 | 4.8 | 5.2 | 5.2 |
| Industrialized Sweet Bread | KG | 79.0 | 83.1 | 87.6 | 101.8 | 106.4 |
| Pancakes, cakes, pastries | KG | 98.1 | 106.4 | 116.7 | 134.0 | 137.7 |
| Juices and Nectars | LT | 16.5 | 16.7 | 16.8 | 17.7 | 17.9 |
| Soft drinks concentrates | LT | 33.0 | 34.8 | 35.8 | 46.2 | 58.7 |
| Orange Juice concentrates | KG | 130.6 | 163.7 | 148.7 | 173.3 | 194.3 |
| Flavored Powder Drink Mix | KG | 166.4 | 165.7 | 164.0 | 161.2 | 163.1 |
| Cola sodas | LT | 11.6 | 12.1 | 12.5 | 14.2 | 14.6 |
| Flavored sodas | LT | 10.0 | 10.4 | 11.1 | 12.7 | 13.1 |
| Flavored waters | LT | 11.5 | 10.9 | 11.5 | 12.6 | 12.3 |
| Bottled water | LT | 6.3 | 6.6 | 6.3 | 6.4 | 6.5 |
| Light cola sodas | LT | 14.1 | 14.6 | 15.4 | 16.6 | 17.2 |
| Whole milk | LT | 12.0 | 12.4 | 13.1 | 13.6 | 14.2 |
| Skimmed milk | LT | 12.9 | 13.7 | 14.5 | 14.9 | 15.3 |
| Yoghourt | KG | 23.6 | 24.3 | 26.2 | 27.5 | 29.6 |
| Yoghourt in varied forms | KG | 25.7 | 26.1 | 27.3 | 28.4 | 28.6 |
| Whole Powder Milk | KG | 88.8 | 91.3 | 94.8 | 100.5 | 107.8 |
| Skimmed Powder Milk | KG | 101.2 | 107.1 | 107.9 | 101.4 | 102.1 |
| Whole Wheat Bread | KG | 39.2 | 39.5 | 41.8 | 44.2 | 45.9 |
| Standard sugar | KG | 16.7 | 17.1 | 12.0 | 12.0 | 13.1 |
| Refined Sugar | KG | 20.7 | 22.4 | 16.9 | 16.3 | 16.8 |
| Fresh Fruit | KG | 21.9 | 22.0 | 22.4 | 24.0 | 24.1 |

Source: INEGI – Average Prices

**Annex II. Sales Volume Indexes – Definitions and Values**

**Table II.1: Sales Volume Indexes – Definitions**

| Article 2 , Fraction I, Incise J of the Special Tax on Production and Services (IEPS) | North American Industrial Classification System (NAICS) | Name of the product | Description of the sale index |
|---|---|---|---|
| **Snacks** | 311910 | Snack Foods | Sales volume index of the whole family product published by INEGI |
| | | Potato Chips | Sales volume index (ton) -Fried tortilla, seasoned and/or enchiladas |
| | | Corn Fritters | Sales volume index of corn fritters, including: churritos + fried tortilla + totopos + infladas + popcorn |
| **Candy Store Products** | 311340 | Candies, Chewing Gum and non-Chocolate Confectionery Products | Sales volume index of the whole family product published by INEGI |
| | | Fruit Popsicles | Sales volume index |
| | | Goat Milk Caramel | Sales volume index |
| **Fruit and Vegetable Sweets** | 311422 | Fruit and Vegetable Jams | Sales volume index (tons): Strawberry+Other |
| **Caramel** | 311340 | Caramel | Sales volume index |
| **Sugary Cereals** | 311230 | Sweet Corn Flakes | Sales volume index |
| **Cookies** | 311820 | Cookies (with filling or cover) | With marshmallow, with filling, with cover, without filling, soda crackers. |
| **Sweet Breads** | 311811 | Industrialized Sweet Bread | Sales volumes index published by INEGI |
| **Cakes and Muffins** | 311811 | Pancakes, Cakes and Pastries | Sales volume index, including: pancakes+cakes+muffins with cover |
| **Article 2 , Fraction I, Incise G of the Special Tax on production and Services (IEPS)** | **North American Industrial Classification System (NAICS)** | **Name of the product** | **Description of the sale index** |
| **Sugar Sweetened Beverages** | 311422 | Juices and Fruit Nectars | Sales volume index, including: mango, Orange, Pineapple, Grape, Apples, Peach, Guava and others |
| | 311930 | Soft Drinks Concentrates | Sales volume index |
| | 311930 | Orange Juice Concentrates | Sales volume index |
| | 311930 | Flavored Powder Drink Mix | Sales volume index |

| | | | |
|---|---|---|---|
| | 312111 | Colas sodas | Sales volume index for returnable + non-returnable bottles + cans |
| | 312111 | Flavored Sodas | Sales volume index for returnable and non-returnable bottles |
| | 312111 | Energy or sport drinks | Sales volume index |
| **Substitutes** | **North American Industrial Classification System (NAICS)** | **Name of the product** | **Description of the sale index** |
| **Potential Substitutes** | 312111 | Bottled Water | Sales volume index |
| | 311511 | Whole Milk | Sales volume index: Milk re-hydration+ Pasteurized and Homogenized +Ultrapasteurized |
| | 311511 | Skimmed milk | Sales volume index: Skimmed re-hydration +Pasteurized and homogeneized+Ultrapasteurized |
| | 311511 | Yoghourt | Sales volume index |
| | 311513 | Yoghourt in varied forms | Sales volume index: with fruits or cereals, drinkable, smoothies, cream or soft cheese |
| | 311512 | Whole Powder Milk | Sales volume index |
| | 311512 | Skimmed Powder Milk | Sales volume index |
| | 311811 | Whole wheat bread | Sales volume index |
| | 311311 | Standard sugar production | Sales volume index |
| | 311311 | Refined sugar production | Sales volume index |

Source: Monthly Survey of Manufacturing Industry (EMIM) - INEGI

**Table II.2: Sales Volume Indexes 2007-2015 (10 months)**

| Sales Volume Indexes (2013=100) | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 (10 Months) |
|---|---|---|---|---|---|---|---|---|---|
| Snack Foods | 0.84 | 0.82 | 0.84 | 0.87 | 0.90 | 0.98 | 1 | 0.95 | 1.01 |
| Potato Chips | 0.97 | 0.84 | 0.84 | 0.84 | 0.90 | 0.94 | 1 | 0.91 | 1.02 |
| Corn Fritters | 0.76 | 0.83 | 0.84 | 0.91 | 0.92 | 0.99 | 1 | 0.98 | 1.02 |
| Candies, Chewing Gum and non-Chocolate Confectionery Products | 1.15 | 1.16 | 1.07 | 1.08 | 1.07 | 1.11 | 1 | 0.97 | 1.03 |
| Fruit Popsicles | 0.92 | 1.04 | 1.07 | 1.06 | 1.04 | 1.09 | 1 | 0.90 | 0.94 |
| Goat Milk Caramel | 1.26 | 1.17 | 1.19 | n.d | n.d | 1.14 | 1 | 0.95 | 0.90 |
| Fruit and Vegetable Jams | 0.70 | 0.96 | 0.92 | 0.99 | 0.99 | n.d | 1 | 1.26 | 1.37 |
| Caramel | 0.69 | 0.77 | 0.90 | 0.75 | 0.80 | 0.85 | 1 | 0.91 | 0.87 |
| Sweet Corn Flakes | 0.86 | 0.91 | 1.02 | 1.06 | 1.06 | 1.03 | 1 | 0.91 | n.d |
| Cookies( with filling or cover) | 0.87 | 0.87 | 0.87 | 0.90 | 0.94 | 0.97 | 1 | 0.96 | 1.01 |
| Industrialized Sweet Bread | 0.96 | 0.90 | 0.88 | 0.88 | 0.88 | 0.97 | 1 | 0.94 | 0.89 |
| Pancakes, Cakes and Pastries | 0.93 | 0.93 | 0.97 | 0.98 | 1.00 | 1.03 | 1 | 0.99 | 1.02 |
| Juices and Fruit Nectars | 0.88 | 0.94 | 1.04 | 0.89 | 0.93 | 0.96 | 1 | 1.01 | 1.02 |
| Soft Drinks Concentrates | 1.09 | 1.26 | 1.12 | 1.01 | 1.05 | 1.00 | 1 | 1.03 | 0.86 |
| Orange Juice Concentrates | 0.48 | 0.66 | 0.74 | 0.63 | 0.85 | 0.67 | 1 | 0.96 | 0.86 |
| Flavored Powder Drink Mix | 2.28 | 2.31 | 2.16 | 1.28 | 0.56 | 1.16 | 1 | 1.08 | 0.94 |
| Colas sodas | 0.81 | 0.82 | 0.83 | 0.88 | 0.96 | 0.98 | 1 | 0.99 | 0.98 |
| Flavored Sodas | 0.98 | 0.91 | 0.99 | 0.99 | 1.03 | 1.02 | 1 | 0.97 | 0.97 |
| Energy or sport drinks | 0.86 | 0.86 | 0.73 | 0.72 | 0.90 | 1.14 | 1 | 1.31 | 1.26 |
| Bottled Water | 0.82 | 0.84 | 0.88 | 0.91 | 0.96 | 1.00 | 1 | 1.05 | 1.24 |
| Whole Milk | 1.07 | 1.11 | 1.10 | 1.05 | 0.99 | 0.84 | 1 | 0.91 | 0.80 |
| Skimmed milk | 1.01 | 1.05 | 1.06 | 1.01 | 0.99 | 0.99 | 1 | 0.96 | 0.98 |
| Yoghourt | 0.91 | 0.93 | 0.88 | 0.83 | 1.01 | 1.01 | 1 | 1.07 | 1.17 |
| Yoghourt in varied forms | 0.94 | 0.90 | 0.93 | 1.01 | 1.02 | 1.05 | 1 | 0.94 | 0.98 |
| Whole Powder Milk | 1.09 | 1.01 | 0.96 | 1.03 | 1.06 | 0.93 | 1 | 0.96 | 1.00 |
| Skimmed Powder Milk | 0.44 | 0.46 | 0.42 | 0.45 | 0.53 | 1.21 | 1 | 0.87 | 0.82 |
| Whole wheat bread | 0.85 | 0.82 | 0.75 | 0.80 | 0.90 | 0.96 | 1 | 1.04 | 1.03 |
| Standard Sugar | 0.64 | 0.69 | 0.65 | 0.58 | 0.65 | 0.71 | 1 | 0.91 | 0.87 |
| Refined Sugar | 0.81 | 0.96 | 0.81 | 0.80 | 0.88 | 0.75 | 1 | 0.80 | 0.81 |

Source: Monthly Survey of Manufacturing Industry (EMIM) - INEGI
Sales Volume Index $_T$ = Sales Volume $_T$ / Sales Volume $_{2013}$
Volumes= Tons and liters

**Annex III: TTest for Statistical Significance of Descriptive Analysis of Section VII**

**Table A III.1: TTest-Proportion of Households that Purchased SSBs during the Reference Week. Mexico, 1989-2014**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| **1989** | 0 | | | | | | | | |
| **1994** | -0.065*** | 0 | | | | | | | |
| **2000** | -0.158*** | -0.093*** | 0 | | | | | | |
| **2004** | -0.191*** | -0.126*** | -0.034*** | 0 | | | | | |
| **2006** | -0.192*** | -0.127*** | -0.035*** | -0.001 | 0 | | | | |
| **2008** | -0.237*** | -0.172*** | -0.079*** | -0.046*** | -0.045*** | 0 | | | |
| **2010** | -0.200*** | -0.135*** | -0.042*** | -0.009** | -0.007* | 0.037*** | 0 | | |
| **2012** | -0.202*** | -0.137*** | -0.044*** | -0.010* | -0.009 | 0.035*** | -0.002 | 0 | |
| **2014** | -0.199*** | -0.134*** | -0.041*** | -0.008* | -0.006 | 0.038*** | 0.001 | 0.003 | 0 |

Note: Differences defined as column-line * p<.1; ** p<.05; *** p<.01

**Table A.III.2: TTest- Proportion of Households that Purchased Bottled Water during the Reference Week. Mexico, 1989-2014**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| **1989** | 0 | | | | | | | | |
| **1994** | -0.040*** | 0 | | | | | | | |
| **2000** | -0.206*** | -0.166*** | 0 | | | | | | |
| **2004** | -0.266*** | -0.227*** | -0.060*** | 0 | | | | | |
| **2006** | -0.220*** | -0.180*** | -0.014*** | 0.046*** | 0 | | | | |
| **2008** | -0.257*** | -0.217*** | -0.051*** | 0.010** | -0.037*** | 0 | | | |
| **2010** | -0.241*** | -0.202*** | -0.035*** | 0.025*** | -0.021*** | 0.015*** | 0 | | |
| **2012** | -0.248*** | -0.209*** | -0.042*** | 0.018*** | -0.028*** | 0.008 | -0.007 | 0 | |
| **2014** | -0.292*** | -0.252*** | -0.086*** | -0.026*** | -0.072*** | -0.036*** | -0.051*** | -0.044*** | 0 |

Note: Differences defined as column-line * p<.1; ** p<.05; *** p<.01

**Table A.III.3: TTest- Proportion of Households that Purchased Milk during the Reference Week. Mexico, 1989-2014**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| **1989** | 0 | | | | | | | | |
| **1994** | 0.029*** | 0 | | | | | | | |
| **2000** | -0.031*** | -0.060*** | 0 | | | | | | |
| **2004** | -0.039*** | -0.068*** | -0.008 | 0 | | | | | |
| **2006** | -0.005 | -0.034*** | 0.026*** | 0.034*** | 0 | | | | |
| **2008** | -0.016*** | -0.045*** | 0.015*** | 0.023*** | -0.011** | 0 | | | |
| **2010** | 0.042*** | 0.014*** | 0.074*** | 0.082*** | 0.048*** | 0.058*** | 0 | | |
| **2012** | 0.029*** | 0 | 0.060*** | 0.068*** | 0.034*** | 0.045*** | -0.014** | 0 | |
| **2014** | 0.022*** | -0.006 | 0.054*** | 0.062*** | 0.028*** | 0.038*** | -0.020*** | -0.006 | 0 |

Note: Differences defined as column-line * p<.1; ** p<.05; *** p<.01

**Table A.III.4: TTest- Proportion of Households that Purchased High Calorie Goods during the Reference Week. Mexico, 1989-2014**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| **1989** | 0 | | | | | | | | |
| **1994** | 0.021*** | 0 | | | | | | | |
| **2000** | -0.027*** | -0.047*** | 0 | | | | | | |
| **2004** | -0.025*** | -0.046*** | 0.001 | 0 | | | | | |
| **2006** | -0.034*** | -0.055*** | -0.008 | -0.009* | 0 | | | | |
| **2008** | -0.053*** | -0.073*** | -0.026*** | -0.027*** | -0.018*** | 0 | | | |
| **2010** | -0.040*** | -0.060*** | -0.013** | -0.014*** | -0.005 | 0.013*** | 0 | | |
| **2012** | -0.057*** | -0.078*** | -0.031*** | -0.032*** | -0.023*** | -0.005 | -0.018*** | 0 | |
| **2014** | -0.047*** | -0.068*** | -0.021*** | -0.022*** | -0.013*** | 0.005 | -0.008* | 0.01 | 0 |

Note: Differences defined as column-line * p<.1; ** p<.05; *** p<.01

**Table A.III.5: TTest- Proportion of Households that Purchased Vegetables or Fruits during the Reference Week. Mexico, 1989-2014**

| | 1989 | 1994 | 2000 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|
| **1989** | 0 | | | | | | | |
| **1994** | 0.017*** | 0 | | | | | | |
| **2000** | 0.007 | -0.010** | 0 | | | | | |
| **2006** | 0.048*** | 0.031*** | 0.041*** | 0 | | | | |
| **2008** | -0.010*** | -0.027*** | -0.017*** | -0.058*** | 0 | | | |
| **2010** | -0.008** | -0.024*** | -0.014*** | -0.055*** | 0.002 | 0 | | |
| **2012** | 0.021*** | 0.004 | 0.014*** | -0.027*** | 0.031*** | 0.029*** | 0 | |
| **2014** | 0 | -0.016*** | -0.006 | -0.047*** | 0.010*** | 0.008** | -0.021*** | 0 |

Note: Differences defined as column-line * p<.1; ** p<.05; *** p<.01

**Table A.III.6: TTest- Proportion of Households that Purchased SSBs during the Reference Week by Quintile Mexico, 1989-2014**

**Quintil 1**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 1989 | 0 | | | | | | | | |
| 1994 | -0.051*** | 0 | | | | | | | |
| 2000 | -0.152*** | -0.100*** | 0 | | | | | | |
| 2004 | -0.194*** | -0.143*** | -0.043*** | 0 | | | | | |
| 2006 | -0.224*** | -0.173*** | -0.073*** | -0.030*** | 0 | | | | |
| 2008 | -0.286*** | -0.235*** | -0.134*** | -0.092*** | -0.062*** | 0 | | | |
| 2010 | -0.244*** | -0.193*** | -0.092*** | -0.050*** | -0.020** | 0.042*** | 0 | | |
| 2012 | -0.252*** | -0.201*** | -0.100*** | -0.058*** | -0.028** | 0.034*** | -0.008 | 0 | |
| 2014 | -0.233*** | -0.182*** | -0.081*** | -0.039*** | -0.009 | 0.053*** | 0.011 | 0.019 | 0 |

**Quintil 2**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 1989 | 0 | | | | | | | | |
| 1994 | -0.090*** | 0 | | | | | | | |
| 2000 | -0.187*** | -0.097*** | 0 | | | | | | |
| 2004 | -0.209*** | -0.119*** | -0.022* | 0 | | | | | |
| 2006 | -0.234*** | -0.144*** | -0.047*** | -0.025** | 0 | | | | |
| 2008 | -0.262*** | -0.173*** | -0.075*** | -0.054*** | -0.028*** | 0 | | | |
| 2010 | -0.242*** | -0.152*** | -0.055*** | -0.033*** | -0.008 | 0.020** | 0 | | |
| 2012 | -0.244*** | -0.154*** | -0.057*** | -0.035*** | -0.01 | 0.018 | -0.002 | 0 | |
| 2014 | -0.213*** | -0.123*** | -0.026** | -0.004 | 0.021** | 0.050*** | 0.029*** | 0.031** | 0 |

**Quintil 3**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 1989 | 0 | | | | | | | | |
| 1994 | -0.078*** | 0 | | | | | | | |
| 2000 | -0.175*** | -0.097*** | 0 | | | | | | |
| 2004 | -0.199*** | -0.120*** | -0.024** | 0 | | | | | |
| 2006 | -0.189*** | -0.111*** | -0.014 | 0.01 | 0 | | | | |
| 2008 | -0.222*** | -0.144*** | -0.047*** | -0.023*** | -0.033*** | 0 | | | |
| 2010 | -0.198*** | -0.120*** | -0.023** | 0.001 | -0.009 | 0.024*** | 0 | | |
| 2012 | -0.206*** | -0.127*** | -0.031** | -0.007 | -0.016 | 0.016 | -0.008 | 0 | |
| 2014 | -0.177*** | -0.099*** | -0.002 | 0.022** | 0.012 | 0.045*** | 0.021** | 0.028** | 0 |

**Quintil 4**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 1989 | 0 | | | | | | | | |
| 1994 | -0.086*** | 0 | | | | | | | |
| 2000 | -0.167*** | -0.081*** | 0 | | | | | | |
| 2004 | -0.183*** | -0.097*** | -0.016 | 0 | | | | | |
| 2006 | -0.176*** | -0.090*** | -0.009 | 0.007 | 0 | | | | |
| 2008 | -0.206*** | -0.120*** | -0.039*** | -0.023*** | -0.030*** | 0 | | | |
| 2010 | -0.174*** | -0.088*** | -0.008 | 0.008 | 0.001 | 0.031*** | 0 | | |
| 2012 | -0.184*** | -0.098*** | -0.017 | -0.002 | -0.009 | 0.021* | -0.01 | 0 | |
| 2014 | -0.192*** | -0.106*** | -0.026** | -0.01 | -0.017* | 0.013 | -0.018** | -0.008 | 0 |

**Quintil 5**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 1989 | 0 | | | | | | | | |
| 1994 | -0.087*** | 0 | | | | | | | |
| 2000 | -0.145*** | -0.058*** | 0 | | | | | | |
| 2004 | -0.156*** | -0.069*** | -0.012 | 0 | | | | | |
| 2006 | -0.166*** | -0.079*** | -0.021* | -0.01 | 0 | | | | |
| 2008 | -0.200*** | -0.113*** | -0.055*** | -0.044*** | -0.034*** | 0 | | | |
| 2010 | -0.160*** | -0.072*** | -0.015 | -0.003 | 0.006 | 0.040*** | 0 | | |
| 2012 | -0.164*** | -0.077*** | -0.019 | -0.008 | 0.002 | 0.036*** | -0.004 | 0 | |
| 2014 | -0.189*** | -0.102*** | -0.044*** | -0.033*** | -0.023** | 0.011 | -0.029*** | -0.025* | 0 |

Note: Differences defined as column-line * p<.1; ** p<.05; *** p<.01

**Table A.III.7: TTest- Proportion of Households that Purchased Bottled Water during the Reference Week by Quintile Mexico, 1989-2014**

**Quintil 1**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 1989 | 0 | | | | | | | | |
| 1994 | -0.015*** | 0 | | | | | | | |
| 2000 | -0.113*** | -0.097*** | 0 | | | | | | |
| 2004 | -0.164*** | -0.149*** | -0.051*** | 0 | | | | | |
| 2006 | -0.134*** | -0.118*** | -0.021** | 0.030*** | 0 | | | | |
| 2008 | -0.154*** | -0.139*** | -0.042*** | 0.01 | -0.021*** | 0 | | | |
| 2010 | -0.168*** | -0.152*** | -0.055*** | -0.004 | -0.034*** | -0.013* | 0 | | |
| 2012 | -0.164*** | -0.149*** | -0.051*** | 0 | -0.030*** | -0.01 | 0.004 | 0 | |
| 2014 | -0.220*** | -0.205*** | -0.107*** | -0.056*** | -0.086*** | -0.066*** | -0.052*** | -0.056*** | 0 |

**Quintil 2**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 1989 | 0 | | | | | | | | |
| 1994 | -0.035*** | 0 | | | | | | | |
| 2000 | -0.202*** | -0.167*** | 0 | | | | | | |
| 2004 | -0.265*** | -0.230*** | -0.063*** | 0 | | | | | |
| 2006 | -0.229*** | -0.193*** | -0.027** | 0.036*** | 0 | | | | |
| 2008 | -0.241*** | -0.206*** | -0.039*** | 0.024*** | -0.012 | 0 | | | |
| 2010 | -0.233*** | -0.198*** | -0.031*** | 0.032*** | -0.005 | 0.008 | 0 | | |
| 2012 | -0.243*** | -0.208*** | -0.041*** | 0.022* | -0.014 | -0.002 | -0.009 | 0 | |
| 2014 | -0.288*** | -0.253*** | -0.087*** | -0.023** | -0.060*** | -0.048*** | -0.055*** | -0.046*** | 0 |

**Quintil 3**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 1989 | 0 | | | | | | | | |
| 1994 | -0.040*** | 0 | | | | | | | |
| 2000 | -0.235*** | -0.195*** | 0 | | | | | | |
| 2004 | -0.283*** | -0.243*** | -0.048*** | 0 | | | | | |
| 2006 | -0.244*** | -0.204*** | -0.009 | 0.039*** | 0 | | | | |
| 2008 | -0.275*** | -0.235*** | -0.040*** | 0.008 | -0.031*** | 0 | | | |
| 2010 | -0.262*** | -0.222*** | -0.027** | 0.021** | -0.018* | 0.013 | 0 | | |
| 2012 | -0.265*** | -0.224*** | -0.029* | 0.019 | -0.02 | 0.011 | -0.003 | 0 | |
| 2014 | -0.307*** | -0.266*** | -0.071*** | -0.023** | -0.063*** | -0.032*** | -0.045*** | -0.042*** | 0 |

**Quintil 4**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 1989 | 0 | | | | | | | | |
| 1994 | -0.084*** | 0 | | | | | | | |
| 2000 | -0.285*** | -0.201*** | 0 | | | | | | |
| 2004 | -0.302*** | -0.218*** | -0.017 | 0 | | | | | |
| 2006 | -0.258*** | -0.175*** | 0.026** | 0.044*** | 0 | | | | |
| 2008 | -0.285*** | -0.202*** | -0.001 | 0.016* | -0.027*** | 0 | | | |
| 2010 | -0.271*** | -0.188*** | 0.013 | 0.031*** | -0.013 | 0.014 | 0 | | |
| 2012 | -0.306*** | -0.222*** | -0.021 | -0.004 | -0.048*** | -0.021 | -0.035*** | 0 | |
| 2014 | -0.327*** | -0.243*** | -0.042*** | -0.025** | -0.069*** | -0.041*** | -0.056*** | -0.021 | 0 |

**Quintil 5**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 1989 | 0 | | | | | | | | |
| 1994 | -0.064*** | 0 | | | | | | | |
| 2000 | -0.239*** | -0.175*** | 0 | | | | | | |
| 2004 | -0.297*** | -0.233*** | -0.058*** | 0 | | | | | |
| 2006 | -0.264*** | -0.200*** | -0.025* | 0.033*** | 0 | | | | |
| 2008 | -0.314*** | -0.250*** | -0.075*** | -0.017* | -0.050*** | 0 | | | |
| 2010 | -0.299*** | -0.235*** | -0.060*** | -0.002 | -0.035*** | 0.015 | 0 | | |
| 2012 | -0.330*** | -0.266*** | -0.091*** | -0.033** | -0.066*** | -0.016 | -0.031** | 0 | |
| 2014 | -0.332*** | -0.268*** | -0.093*** | -0.035*** | -0.068*** | -0.018* | -0.033*** | -0.002 | 0 |

Note: Differences defined as column-line * p<.1; ** p<.05; *** p<.01

**Table A.III.8: TTest- Proportion of Households that Purchased Milk during the Reference Week by Quintile Mexico, 1989-2014**

**Quintil 1**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 1989 | 0 | | | | | | | | |
| 1994 | 0.008 | 0 | | | | | | | |
| 2000 | -0.080*** | -0.088*** | 0 | | | | | | |
| 2004 | -0.070*** | -0.078*** | 0.01 | 0 | | | | | |
| 2006 | -0.089*** | -0.097*** | -0.009 | -0.019* | 0 | | | | |
| 2008 | -0.120*** | -0.127*** | -0.039*** | -0.049*** | -0.030*** | 0 | | | |
| 2010 | -0.075*** | -0.083*** | 0.005 | -0.005 | 0.014 | 0.044*** | 0 | | |
| 2012 | -0.101*** | -0.108*** | -0.021 | -0.030** | -0.011 | 0.019 | -0.025** | 0 | |
| 2014 | -0.136*** | -0.144*** | -0.056*** | -0.066*** | -0.047*** | -0.017 | -0.061*** | -0.035*** | 0 |

**Quintil 2**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 1989 | 0 | | | | | | | | |
| 1994 | 0.021 | 0 | | | | | | | |
| 2000 | -0.080*** | -0.101*** | 0 | | | | | | |
| 2004 | -0.081*** | -0.102*** | -0.001 | 0 | | | | | |
| 2006 | -0.074*** | -0.095*** | 0.006 | 0.007 | 0 | | | | |
| 2008 | -0.043*** | -0.064*** | 0.037*** | 0.038*** | 0.031*** | 0 | | | |
| 2010 | 0.014 | -0.007 | 0.094*** | 0.095*** | 0.088*** | 0.057*** | 0 | | |
| 2012 | -0.021 | -0.042*** | 0.060*** | 0.061*** | 0.054*** | 0.023* | -0.034** | 0 | |
| 2014 | -0.012 | -0.033*** | 0.068*** | 0.069*** | 0.062*** | 0.032*** | -0.025** | 0.009 | 0 |

**Quintil 3**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 1989 | 0 | | | | | | | | |
| 1994 | -0.006 | 0 | | | | | | | |
| 2000 | -0.051*** | -0.044*** | 0 | | | | | | |
| 2004 | -0.054*** | -0.048*** | -0.003 | 0 | | | | | |
| 2006 | -0.022* | -0.016 | 0.029** | 0.032*** | 0 | | | | |
| 2008 | -0.008 | -0.001 | 0.043*** | 0.046*** | 0.014 | 0 | | | |
| 2010 | 0.032*** | 0.039*** | 0.083*** | 0.087*** | 0.054*** | 0.040*** | 0 | | |
| 2012 | 0.021 | 0.027* | 0.071*** | 0.075*** | 0.043*** | 0.028** | -0.012 | 0 | |
| 2014 | 0.039*** | 0.046*** | 0.090*** | 0.094*** | 0.061*** | 0.047*** | 0.007 | 0.019 | 0 |

**Quintil 4**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 1989 | 0 | | | | | | | | |
| 1994 | 0.014 | 0 | | | | | | | |
| 2000 | -0.023* | -0.037*** | 0 | | | | | | |
| 2004 | -0.004 | -0.019* | 0.018 | 0 | | | | | |
| 2006 | 0.035*** | 0.021* | 0.058*** | 0.039*** | 0 | | | | |
| 2008 | 0.048*** | 0.033*** | 0.071*** | 0.052*** | 0.013 | 0 | | | |
| 2010 | 0.092*** | 0.078*** | 0.115*** | 0.097*** | 0.057*** | 0.044*** | 0 | | |
| 2012 | 0.065*** | 0.050*** | 0.087*** | 0.069*** | 0.030** | 0.017 | -0.028** | 0 | |
| 2014 | 0.096*** | 0.081*** | 0.118*** | 0.100*** | 0.061*** | 0.048*** | 0.003 | 0.031** | 0 |

**Quintil 5**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 1989 | 0 | | | | | | | | |
| 1994 | -0.01 | 0 | | | | | | | |
| 2000 | 0.02 | 0.029** | 0 | | | | | | |
| 2004 | 0.039*** | 0.049*** | 0.02 | 0 | | | | | |
| 2006 | 0.079*** | 0.089*** | 0.060*** | 0.040*** | 0 | | | | |
| 2008 | 0.058*** | 0.068*** | 0.039*** | 0.019** | -0.021** | 0 | | | |
| 2010 | 0.117*** | 0.126*** | 0.097*** | 0.077*** | 0.038*** | 0.059*** | 0 | | |
| 2012 | 0.113*** | 0.123*** | 0.094*** | 0.074*** | 0.034** | 0.055*** | -0.004 | 0 | |
| 2014 | 0.113*** | 0.122*** | 0.093*** | 0.073*** | 0.034*** | 0.055*** | -0.004 | 0 | 0 |

Note: Differences defined as column-line * p<.1; ** p<.05; *** p<.01

**Table A.III.9: TTest- Proportion of Households that Purchased High Calorie Goods during the Reference Week by Quintile Mexico, 1989-2014**

**Quintil 1**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 1989 | 0 | | | | | | | | |
| 1994 | -0.018 | 0 | | | | | | | |
| 2000 | -0.089*** | -0.071*** | 0 | | | | | | |
| 2004 | -0.080*** | -0.062*** | 0.009 | 0 | | | | | |
| 2006 | -0.120*** | -0.102*** | -0.031** | -0.040*** | 0 | | | | |
| 2008 | -0.145*** | -0.127*** | -0.056*** | -0.065*** | -0.025** | 0 | | | |
| 2010 | -0.137*** | -0.120*** | -0.049*** | -0.058*** | -0.018* | 0.007 | 0 | | |
| 2012 | -0.149*** | -0.131*** | -0.060*** | -0.069*** | -0.029** | -0.004 | -0.012 | 0 | |
| 2014 | -0.158*** | -0.141*** | -0.070*** | -0.079*** | -0.039*** | -0.014 | -0.021** | -0.009 | 0 |

**Quintil 2**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 1989 | 0 | | | | | | | | |
| 1994 | 0.026* | 0 | | | | | | | |
| 2000 | -0.051*** | -0.077*** | 0 | | | | | | |
| 2004 | -0.046*** | -0.071*** | 0.006 | 0 | | | | | |
| 2006 | -0.063*** | -0.088*** | -0.012 | -0.017 | 0 | | | | |
| 2008 | -0.071*** | -0.096*** | -0.019 | -0.025** | -0.008 | 0 | | | |
| 2010 | -0.069*** | -0.094*** | -0.017 | -0.023** | -0.006 | 0.002 | 0 | | |
| 2012 | -0.103*** | -0.128*** | -0.051*** | -0.057*** | -0.040*** | -0.032** | -0.034*** | 0 | |
| 2014 | -0.078*** | -0.104*** | -0.027** | -0.033*** | -0.016 | -0.008 | -0.01 | 0.024* | 0 |

**Quintil 3**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 1989 | 0 | | | | | | | | |
| 1994 | 0.030** | 0 | | | | | | | |
| 2000 | -0.013 | -0.043*** | 0 | | | | | | |
| 2004 | -0.016 | -0.046*** | -0.003 | 0 | | | | | |
| 2006 | -0.013 | -0.043*** | 0 | 0.003 | 0 | | | | |
| 2008 | -0.029** | -0.060*** | -0.016 | -0.013 | -0.016 | 0 | | | |
| 2010 | -0.016 | -0.047*** | -0.003 | 0 | -0.003 | 0.013 | 0 | | |
| 2012 | -0.057*** | -0.087*** | -0.044*** | -0.041*** | -0.044*** | -0.028** | -0.041*** | 0 | |
| 2014 | -0.022* | -0.052*** | -0.009 | -0.006 | -0.009 | 0.007 | -0.006 | 0.035** | 0 |

**Quintil 4**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 1989 | 0 | | | | | | | | |
| 1994 | 0.026* | 0 | | | | | | | |
| 2000 | 0.018 | -0.008 | 0 | | | | | | |
| 2004 | 0.015 | -0.011 | -0.003 | 0 | | | | | |
| 2006 | 0 | -0.026** | -0.018 | -0.015 | 0 | | | | |
| 2008 | -0.008 | -0.034*** | -0.026** | -0.023** | -0.008 | 0 | | | |
| 2010 | 0.008 | -0.017 | -0.01 | -0.007 | 0.009 | 0.017* | 0 | | |
| 2012 | -0.007 | -0.032** | -0.025 | -0.022 | -0.006 | 0.002 | -0.015 | 0 | |
| 2014 | 0.004 | -0.022* | -0.014 | -0.011 | 0.004 | 0.012 | -0.004 | 0.011 | 0 |

**Quintil 5**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 1989 | 0 | | | | | | | | |
| 1994 | -0.009 | 0 | | | | | | | |
| 2000 | -0.018 | -0.009 | 0 | | | | | | |
| 2004 | 0.009 | 0.018 | 0.027** | 0 | | | | | |
| 2006 | 0.012 | 0.021 | 0.030** | 0.003 | 0 | | | | |
| 2008 | -0.006 | 0.003 | 0.013 | -0.015 | -0.018* | 0 | | | |
| 2010 | 0.009 | 0.018 | 0.027** | 0 | -0.003 | 0.015 | 0 | | |
| 2012 | 0.015 | 0.024 | 0.034* | 0.006 | 0.003 | 0.021 | 0.006 | 0 | |
| 2014 | 0.017 | 0.026* | 0.036** | 0.008 | 0.005 | 0.023** | 0.008 | 0.002 | 0 |

Note: Differences defined as column-line * p<.1; ** p<.05; *** p<.01

**Table A.III.10: TTest- Proportion of Households that Purchased Complementary High Calorie Goods during the Reference Week by Quintile Mexico, 1989-2014**

**Quintil 1**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 1989 | 0 | | | | | | | | |
| 1994 | -0.003 | 0 | | | | | | | |
| 2000 | -0.050*** | -0.047*** | 0 | | | | | | |
| 2004 | -0.004 | -0.001 | 0.046*** | 0 | | | | | |
| 2006 | -0.001 | 0.002 | 0.049*** | 0.003 | 0 | | | | |
| 2008 | -0.073*** | -0.070*** | -0.023** | -0.069*** | -0.072*** | 0 | | | |
| 2010 | -0.071*** | -0.068*** | -0.022** | -0.067*** | -0.071*** | 0.002 | 0 | | |
| 2012 | -0.030** | -0.027** | 0.019* | -0.026** | -0.029*** | 0.043*** | 0.041*** | 0 | |
| 2014 | -0.062*** | -0.059*** | -0.012 | -0.058*** | -0.061*** | 0.011 | 0.009 | -0.032*** | 0 |

**Quintil 2**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 1989 | 0 | | | | | | | | |
| 1994 | 0.017* | 0 | | | | | | | |
| 2000 | 0.003 | -0.014 | 0 | | | | | | |
| 2004 | 0.049*** | 0.031*** | 0.046*** | 0 | | | | | |
| 2006 | 0.046*** | 0.029*** | 0.043*** | -0.002 | 0 | | | | |
| 2008 | 0.005 | -0.013 | 0.002 | -0.044*** | -0.041*** | 0 | | | |
| 2010 | 0.006 | -0.011 | 0.003 | -0.042*** | -0.040*** | 0.001 | 0 | | |
| 2012 | 0.029*** | 0.011 | 0.026** | -0.020* | -0.018* | 0.024*** | 0.022** | 0 | |
| 2014 | 0.011 | -0.006 | 0.008 | -0.037*** | -0.035*** | 0.006 | 0.005 | -0.017* | 0 |

**Quintil 3**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 1989 | 0 | | | | | | | | |
| 1994 | 0.013 | 0 | | | | | | | |
| 2000 | 0 | -0.012 | 0 | | | | | | |
| 2004 | 0.043*** | 0.030*** | 0.042*** | 0 | | | | | |
| 2006 | 0.054*** | 0.041*** | 0.054*** | 0.011 | 0 | | | | |
| 2008 | 0.002 | -0.011 | 0.001 | -0.041*** | -0.052*** | 0 | | | |
| 2010 | 0.003 | -0.01 | 0.002 | -0.040*** | -0.051*** | 0.001 | 0 | | |
| 2012 | 0.022** | 0.009 | 0.022** | -0.021** | -0.032*** | 0.020** | 0.019** | 0 | |
| 2014 | 0.01 | -0.003 | 0.009 | -0.033*** | -0.044*** | 0.008 | 0.007 | -0.013 | 0 |

**Quintil 4**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 1989 | 0 | | | | | | | | |
| 1994 | 0.021** | 0 | | | | | | | |
| 2000 | 0.056*** | 0.035*** | 0 | | | | | | |
| 2004 | 0.071*** | 0.050*** | 0.015 | 0 | | | | | |
| 2006 | 0.072*** | 0.051*** | 0.016 | 0.001 | 0 | | | | |
| 2008 | 0.020** | -0.001 | -0.036*** | -0.051*** | -0.052*** | 0 | | | |
| 2010 | 0.021*** | 0.001 | -0.035*** | -0.050*** | -0.051*** | 0.001 | 0 | | |
| 2012 | 0.043*** | 0.022** | -0.013 | -0.028*** | -0.029*** | 0.023** | 0.022** | 0 | |
| 2014 | 0.025*** | 0.004 | -0.031*** | -0.046*** | -0.047*** | 0.005 | 0.004 | -0.018* | 0 |

**Quintil 5**

| | 1989 | 1994 | 2000 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 1989 | 0 | | | | | | | | |
| 1994 | 0.019* | 0 | | | | | | | |
| 2000 | 0.027** | 0.008 | 0 | | | | | | |
| 2004 | 0.063*** | 0.043*** | 0.035*** | 0 | | | | | |
| 2006 | 0.059*** | 0.039*** | 0.031*** | -0.004 | 0 | | | | |
| 2008 | -0.001 | -0.021** | -0.029*** | -0.064*** | -0.060*** | 0 | | | |
| 2010 | 0.001 | -0.019** | -0.027*** | -0.062*** | -0.058*** | 0.002 | 0 | | |
| 2012 | 0.032*** | 0.013 | 0.005 | -0.030*** | -0.027** | 0.034*** | 0.032*** | 0 | |
| 2014 | 0.018* | -0.002 | -0.01 | -0.045*** | -0.041*** | 0.019*** | 0.017** | -0.015 | 0 |

Note: Differences defined as column-line * p<.1; ** p<.05; *** p<.01

**Annex IV: Methodology to Estimate the Own-price and Cross-price Elasticities of Demand of Foods and Beverages Subject to the Tax**

The model explained in detailed in this section will be used to describe the possible effect of the taxes on sweetened beverages and foods of low nutritional value. Specifically we will estimate the price-elasticity of demand of sweetened beverages; the price-elasticity of demand of high calorie foods subject to the second tax, and the cross-elasticities of demand of related products; for instance, the cross-elasticity of demand of milk and bottled water to a change in the price of sweetened beverages using data from the years before and after the enactment of the tax law.

Since the estimation of the demand for sodas and high-calorie foods using micro-data is censored, that is, there are households that do not consume these goods and thus total consumption for these households is zero, we will use Heckman two-step estimation for the demand for sodas and high calorie foods following Parks and Capps (1997). We will first estimate the probability of households buying sweetened beverages/high calorie foods and in the second step we will estimate the demand for these two goods.

First step:

$$Z_{ih} = f_i (X_h, Y_h, D_h)$$

Where Z is 1 if house "h" buys good "i" and 0 otherwise.

$X_h$: is a vector of household characteristics, including: income; household size, region of residence.

$Y_h$: is a vector of meal planner characteristics

$D_h$: is a dummy variable indicating whether the household is "healthy conscious". We are using as a variably indicating this, whether or not the household owns a bicycle.

Second step:

$$Qih = fi (Xh, Pi^*, Pj^*, \gamma t, \lambda ih)$$

Where Qih is the quantity of the sweetened beverage or high calorie food "i" bought by household h and IMR is the inverse of the Mills ratio calculated from the first step equation.

Pi*:quality-adjusted price of taxed items

Pj*: quality-adjusted price of substitute food items

$\gamma t$: this is a vector of dummy variables representing year fix effects

$\lambda ih$: this is the inverse of the Mills ratio calculated from the first step equation

We expect the characteristics of the meal planner to have an impact on the probability of a household buying or not sweetened beverages and high-calorie foods, some of these characteristics are unique to the decision to buy; we expect that healthy conscious meal planners are not likely to buy sweetened beverages or high calorie foods. To proxy as "health consciousness" of the meal planner we are using the following characteristics: age, education level, gender, and a dummy variable indicating whether the household owns a sporting good (in this case a bicycle). We assume that the meal planner is the household head if it is a single headed household and the female of the household in a two-headed household or household with a

married head. We expect that younger, female and meal planners with a higher education level and that own exercise equipment are more likely to be health conscious.

The cross sectional household surveys we have for this analysis provide information on expenditure in a food item and the quantity of the item. Thus prices are estimated. These prices however are prices of a bundle of goods, they can varied in brand name or in other quality characteristics that are not observable. Thus to avoid a bias estimation, prices would need to be adjusted by quality. Following the work of Cox and Wohlgenant (1985), Park and Capps (1997), and Kuchler et al (2004), we estimate the quality-adjusted prices as the summation of the error term and the intercept of the following regression:

$$P_i^* = f_i\,(X_h,\ Y_h,\ Z_h,\ \gamma_t,\ \lambda_{ih})$$

Where $Z_h$: is a variable that indicates whether the household bought the food or beverage in a "*tienda de abarrotes*" which are mom and pop stores where most beverages are sold. These stores are likely to offer lower prices than supermarkets or specialty stores, where consumers are paying for other services and advertising. In both the quantity and price equations, the square of the income and household sizes were included under the assumption that there are economies of scale in the purchase and consumption of goods.

Faced with a large and increasing obesity epidemic, the Mexican Government in the last years has increased efforts to prevent and control it. In October 2013, Mexico's Congress passed legislation imposing taxes on sugar-sweetened beverages (SSBs) and calorie-dense foods of low nutritional value. These taxes were part of a comprehensive strategy to prevent and control obesity, overweight and diabetes. In addition to fiscal policy and regulation, this strategy included other health promotion and prevention interventions as well as measures to ensure better access to effective health care services. The decision to implement this fiscal policy was the result of a long advocacy process in which different actors participated, including civil society organizations and government agencies, which provided needed evidence on the status of the epidemic and options to fight against it. The taxes were designed to avoid, as much as possible, the substitution of consumption of the taxed goods for other unhealthy foods and beverages not subject to taxation. These taxes have been successful in increasing both the fiscal revenues and the price of the products taxed. There is also evidence that they have reduced consumption, particularly of SSBs. The taxes seem to have the highest impact among people in the poorest quintiles of the income distribution, who had experienced the highest increase in consumption of the goods under taxation in the last years. A debate remains on the actual impact of the taxes, particularly on health outcomes. Thus it is important to continue monitoring the impact of the taxes through the development of price and volume indicators based on publicly available data.

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