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The Non-Alcoholic Beverage Industry in Mexico

Centro de Investigaciones Económicas

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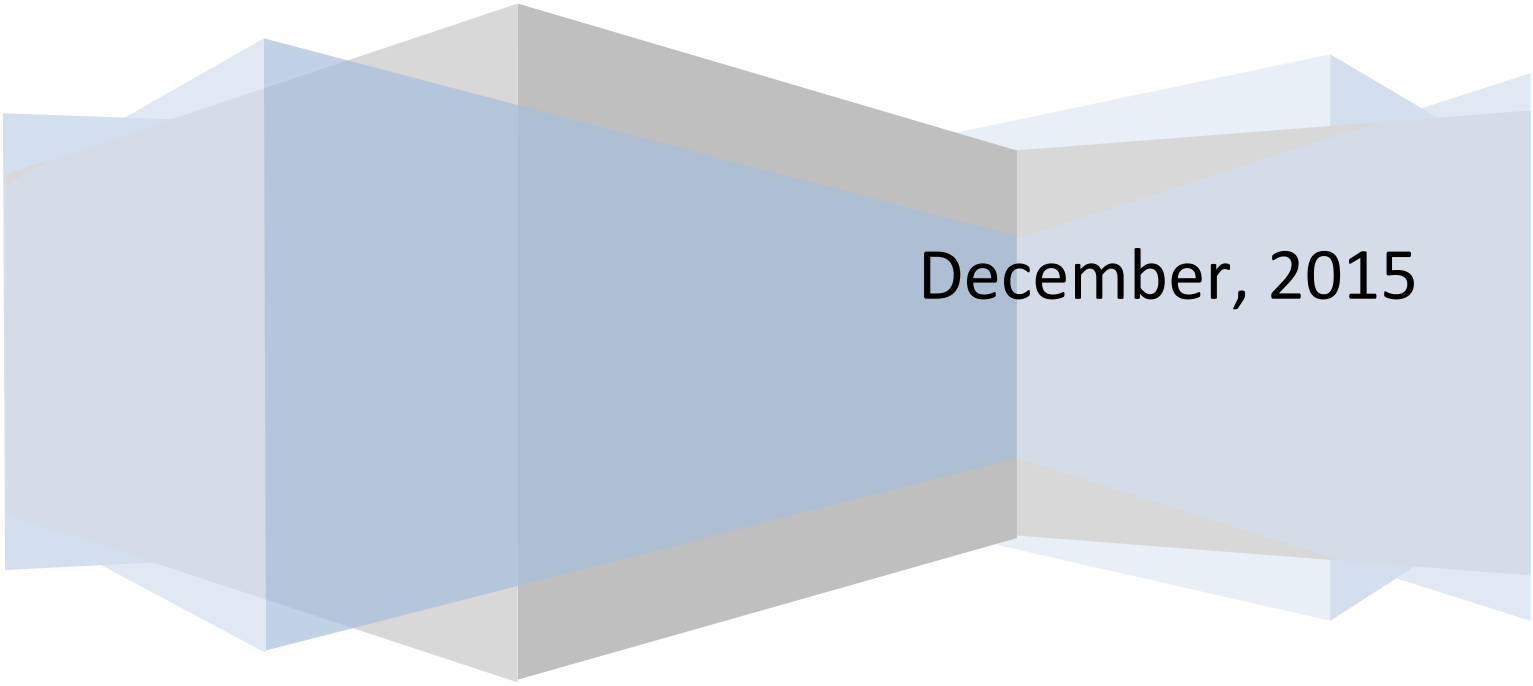

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Introduction

This document is the result of a research project that encompasses two studies on the Non-Alcoholic Beverage Industry (NAB). The first study is a diagnosis of the industry. The main goal of this study is to identify the current situation of the industry and its evolution over the past number of years. The main sources of information used in this part of the document stem from the National Household Income and Expenditure Survey (ENIGH) and the Monthly Survey of the Manufacturing Industry (EMIM). The document also contains an analysis of the NAB industry's productive structure and its relationship with the rest of the economy. Information was taken most from the domestic economy Input-Output Table (IOT).

As in any research project, the objective of this document is to answer a number of questions concerning the NAB industry and, more specifically, the soft drink industry. What is the scale of the NAB industry? With which sectors of the economy is this industry linked? What are the major products offered by the NAB industry? Are these normal goods in an economic sense? What have consumer NAB trends been over recent decades and the past few years? How many liters of soft drinks on average are consumed per capita in the country? What is growing faster – the consumption of bottled water or the consumption of soft drinks? The purpose of this document is to answer these and other questions. In order to do so, statistical, economic or econometric methodologies were used, depending on which was deemed to be more adequate based on the characteristics of the available information.

Each one of these questions leads to a number of answers. For example, when posing the question regarding the size of the NAB industry, there are a number of different ways to answer. If we measure it based on the importance of NAB in terms of domestic household consumption, then the goods produced by this industry represent 2.7% of total expenditure. Alternatively, if we calculate the industry's contribution to gross output, both directly and indirectly, we find that it is responsible for 1.07% of gross output. In either eventuality, we see that the NAB industry plays an important role in the domestic economy.

Although it is neither the only nor the main focus of this document, one of the concerns that this paper aims to tackle is how to measure the effects of the $1 peso per liter tax on sugary drinks, implemented at the beginning of 2014. In terms of this question, the following conclusion was reached: the tax was passed on to consumers by means of a price increase. The effect on the consumption of soft drinks was small (it led to a reduction of 3%). As such, the tax had no significant impact on the average caloric intake of people in Mexico (calorie consumption only dropped by 0.21%), but it did have a major impact on tax revenue. Given that soft drinks are deemed necessary goods in an economic sense, the taxation policy had a negative impact, especially on the poorest households. This tax also had an effect on the economy in general. Based on the most conservative estimates, it is estimated that gross output dropped by $6.454 billion pesos (0.04% of the GDP). Furthermore, the tax led to the loss of more than 10,000 jobs.

The rest of the document is organized in the following manner. In Chapter 1, a review of the importance of the household consumption of beverages based on income level is presented, in addition to analyzing its recent evolution and the variables that affect consumption. In Chapter 2, a diagnosis of the historical evolution of the sales of beverages in the country is shown, in addition to a diagnosis of the behavior of employment and production in this industry. In Chapter 3, a study of the entire beverage industry is presented, using an input-output focus in order to establish the relationship between this industry and the rest of the economy. In Chapter 4, an analysis of the effect of the tax on sugary drinks (or those with a high caloric content), which came into force in 2014, is presented. At the end of the document there is an appendix encompassing the major conclusions of this study.

1. Beverage Consumption in Mexico

An important part of household spending in Mexico is earmarked for the purchase of food and drink. According to the most recent information from the National Household Income and Expenditure Survey (ENIGH), from 2014, households in the country spent an average of $106,027 pesos on the acquisition of goods and services.[1] The majority of this expenditure (close to 70%) was earmarked for the acquisition of goods and services relating to three major areas: nutrition, housing and transport. To be more precise, households assigned 34.1% of their expenditure on food and non-alcoholic beverages, 15.7% on housing services and 18.8% on transport and communication services. It is therefore clear that the food and non-alcoholic beverages segment is the most significant in terms of domestic household spending.

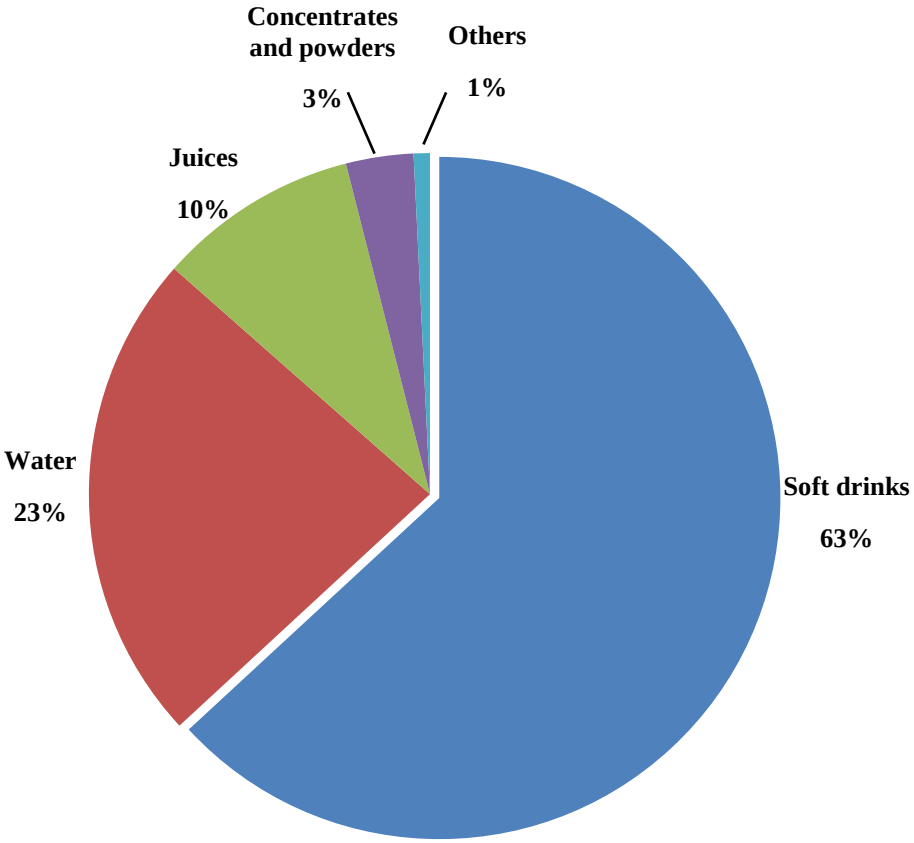
It is important to highlight the fact that the areas mentioned in the previous paragraph are large-scale aggregates. For example, the food and non-alcoholic beverage segment encompasses a whole range of products such as meat, potatoes, eggs, chicken, cereals, soft drinks, bottled water, juices, tea, coffee, etc. Similarly, housing services encompass rental and construction costs, as well as electricity, telephony or water services. Transport and communication services include the acquisition of vehicles and their maintenance and public transport services, among many others.

Beverages play a major role in household spending on food and non-alcoholic beverages. According to data from the 2014 ENIGH, households in the country spent an average of $2,250 pesos per year on non-alcoholic beverages for consumption at home. As such, expenditure on non-alcoholic beverages consumed within the home represents almost 7.8% of the total spending on food and drink. It should be explained that beverages consumed outside the home are recorded in the aggregate of food consumed outside the home. As such, the consumption of non-alcoholic beverages is more than likely underestimated in the ENIGH.

[1] According to the 2013 National Household Spending Survey (ENGASTO), the average spending for that year was $144,912 pesos. Most of household spending was directed to food and beverages (24.8%), housing services (19.8%) and transport and communication services (13.4%).

The most widely-consumed beverages in households in the country are soft drinks, water (both still and sparkling) and juices. Figure 1 shows the proportion of each one of the beverages as part of the budget household's earmark for non-alcoholic beverages. It is important to highlight how approximately 96% of household spending on non-alcoholic beverages is focused on the three products mentioned above. Furthermore, we must stress how the consumption of soft drinks represents just over half of household spending on non-alcoholic beverages.

Figure 1. Distribution of Household Spending on the Most Relevant NABs



Source: Compiled with information from 2014 ENIGH.

1.1. Income Distribution and Beverage Consumption

In order to achieve a more detailed study regarding household consumption in relation to income level, households were divided into four groups, each containing an identical number of households. Based on their per capita money spending, these groups are the following: Low, Medium-Low, Medium-High and High. Monetary spending is an approximate measure of a household's permanent income. Unlike income, which can be volatile (it can, for example, be zero if the head of the household loses his or her job), spending is relatively stable and, as such, tends to more accurately reflect the standard of living in households.

Table 1 shows households' basic statistics by income level. This information was taken from the 2014 ENIGH. It is important to stress that the number of members per household tends to decrease as income level increases. In order to get a better idea of the standard of living among households, the table below presents average monthly household spending for Low, Medium-Low, Medium-High and High income levels: $3,367.03, $5,821.80, $8,169.30 and $19,628.17, respectively.

Also, Table 1 shows the monthly household budgets (taking into consideration the different income levels) for food and beverages, as well as food consumed away from home (AFH), beverages and soft drinks. Similarly, we can see what the proportion of spending in each of these areas is based on the total household budget. This information offers us an insight into some peculiarities of household spending on food and beverages, as explained below.

Table 1. Monthly Spending by Income Level				
	Low	Medium-Low	Medium-High	High
No. Members	4.67	4.14	3.57	2.77
Monetary Spending	$ 3,367.03	$ 5,821.80	$ 8,169.30	$ 19,628.17
Food	$ 1,572.44	$ 2,524.29	$ 3,212.07	$ 4,733.16
Food AFH	$ 80.23	$ 219.23	$ 455.49	$ 1,562.84
Beverages	$ 115.88	$ 196.90	$ 241.64	$ 328.33
Soft Drinks	$ 73.95	$ 121.17	$ 138.88	$ 138.72
% Food	46.7	43.4	39.3	24.1
% Food AFH	2.4	3.8	5.6	8.0
% Beverages	3.4	3.4	3	1.7
% Soft Drinks	2.2	2.1	1.7	0.7

Source: Compiled with information from 2014 ENIGH

Even though the consumption of food and NAB is important in general terms, the share of these products in household spending depends on the income level of the households themselves. In absolute terms, households spend more on food and beverages as income increases. This means that both food and NAB are normal goods in an economic sense; however, the share of food and beverages on total spending tends to decrease as the income level of the household increases. In other words, food and beverages are necessary goods.

Unlike spending on food and beverages at home, spending on food and beverages away from home (Food AFH) increases as household income increases, both in absolute and relative terms. This means that food consumed away from home can be clearly identified as a luxury good. For example, while low-income households spend practically nothing on food consumed away from home, households with high income levels spend around a third of their budget on food and beverages away from home.

Finally, the consumption of soft drinks demonstrates a peculiar tendency when we consider the relationship with the level of household income. On the one hand, it is clear that they are a necessary good as spending on soft drinks as a proportion of total spending decreases as income level increases. On the other hand, in absolute terms, average spending on soft drinks from households with Medium-Low, Medium-High and High income

levels is practically the same, while low-income households spend approximately 45% less than the other households.[2] This could suggest that soft drinks stop being a normal good for the highest income levels; however, this hypothesis is incorrect as those households with the highest levels of income have fewer members.

Table 2 shows per capita household spending in Mexico by income level. Once the average number of household members is taken into consideration, we can see clearly that spending per person on soft drinks, increases among the households with the highest level of income. As such, soft drinks are clearly a normal good in an economic sense.

Table 2. Per Capita Monthly Spending by Income Level

	Low	Medium-Low	Medium-High	High
No. Members	4.67	4.14	3.57	2.77
Monetary Spending	$ 720.99	$ 1,406.23	$ 2,288.32	$ 7,085.98
Food	$ 336.71	$ 609.73	$ 899.74	$ 1,708.72
Food OH	$ 17.18	$ 52.95	$ 127.59	$ 564.20
Beverages	$ 24.81	$ 47.56	$ 67.69	$ 118.53
Soft drinks	$ 15.84	$ 29.27	$ 38.90	$ 50.08

Source: Compiled with information from 2014 ENIGH

1.2. Recent evolution of the sales of beverages (soft drinks, water and fruit juices)

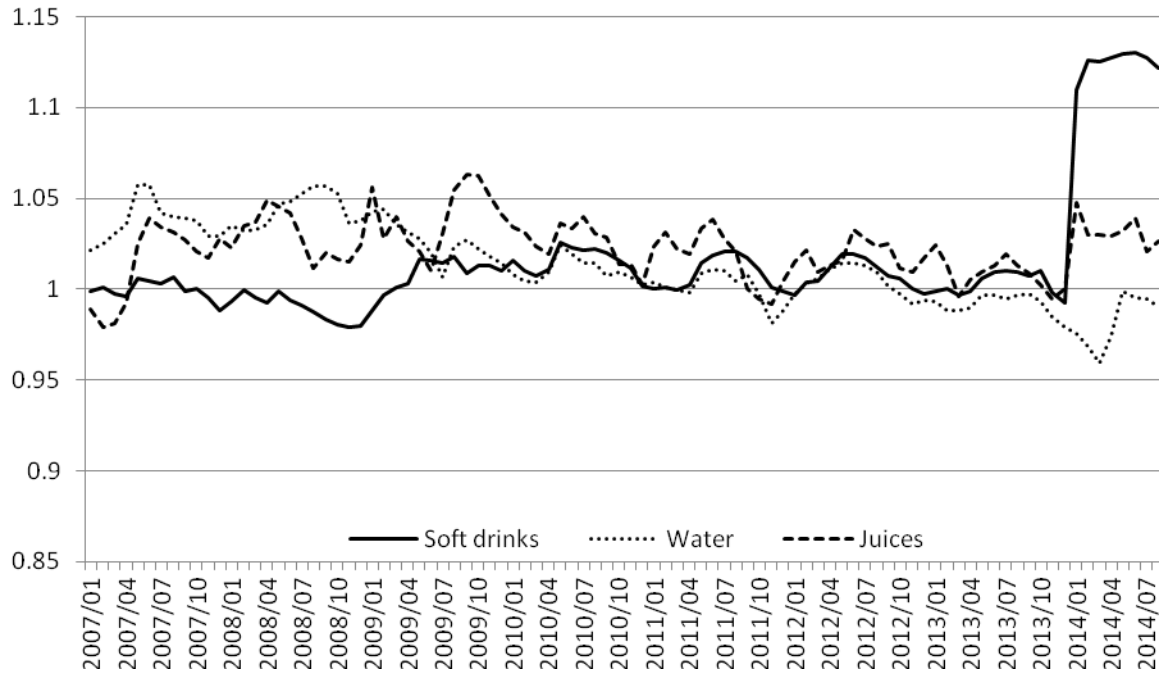
Given that soft drinks, water and juices are the most important beverages in term of household consumption, this section will focus on the recent evolution of sales of these goods in the country. Furthermore, it aims to establish what the economic variables that best explain this evolution are. To achieve this, monthly, publically-available information from the INEGI's Bank of Economic Information (BIE) from January 2007 to August 2014 will be

[2] We can use Table 1 to find the approximate share of households, with different income levels, in revenue stemming from the taxation of sugary drinks. The tax revenue shares are calculated as follows: 15.64% stems from households with a low level of income, 25.63% from households with a medium-low level of income, 29.38% from household with a medium-high level of income and 29.35% from households with a high level of income. Although households pay more taxes as income increases (given that they consume more) the tax burden is greater among the poorest households.

used, specifically, information regarding the sales of beverages from the Monthly Survey of the Manufacturing Industry (EMIM). Information from the National Consumer Price Index (INPC) published by INEGI will also be used, particularly the beverage price index found in the Classification of Individual Consumption According to Purpose (INPC-CCIF).

Figure 2 shows the evolution of the real prices (i.e., prices without inflation) of soft drinks, bottled water and fruit juices over the last number of years. It is relatively clear that the prices of beverages were relatively stable until the tax on sugary drinks came into force. This tax had a specific impact on the price of soft drinks. As can be seen in the graph, at the beginning of 2014 (when the fiscal changes came into effect), the price of soft drinks increased by 12%; however, the price of juices increased by only 5% and the price of water saw only a slight increase in its downward trend. Nevertheless, we can say that, with the exception of the period in which the tax was introduced, the prices of the most important non-alcoholic beverages show relatively small fluctuations and, in the long-term, tend to simply adjust in line with inflation.

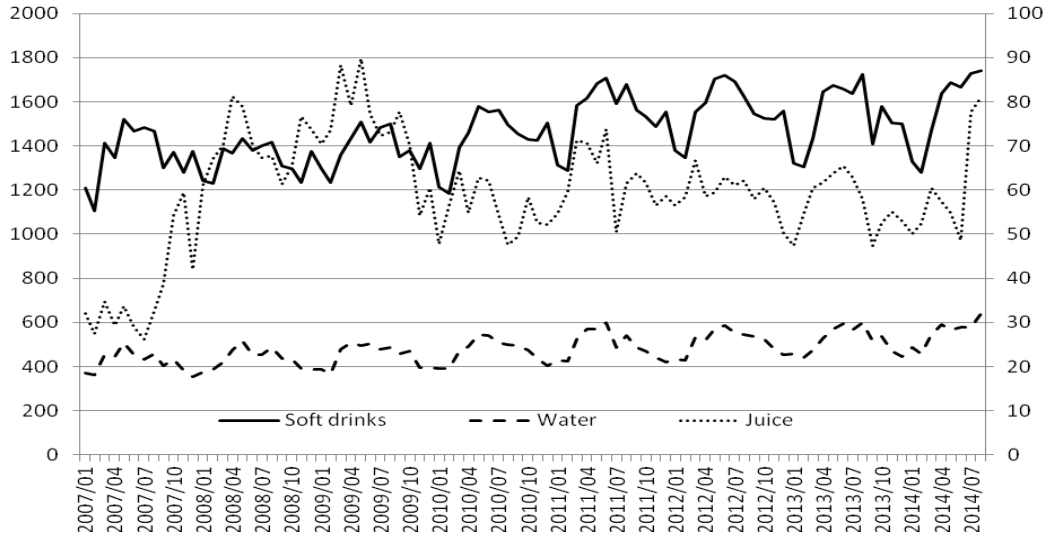
Figure 2. Evolution of the Real Prices of Beverages



Source: Compiled with information from the INPC and the INPC-CCIF published by INEGI.

While the real price of beverages remains relatively stable over time (except at the point in which the tax policy was implemented), there is an upward trend in terms of sales which is subject to very marked seasonal variations. Figure 3 shows the evolution of monthly sales (in millions of liters) of each one of the most important beverages over the last years. The left axis corresponds to soft drinks and water, while the right axis (with much smaller quantities) corresponds to juices. There are two specific conclusions that can be drawn. On the one hand, the sales of all the beverages (soft drinks, juices and water) tend to increase little by little over time. On the other hand, the sales of soft drinks and water, which are those with the greatest significance in the non-alcoholic beverage segment, exhibit (apparently) synchronized cyclical variations compared to the erratic variations seen in the sales of fruit juices.

Figure 3. Monthly Sales of Beverages in Mexico (millions of liters)



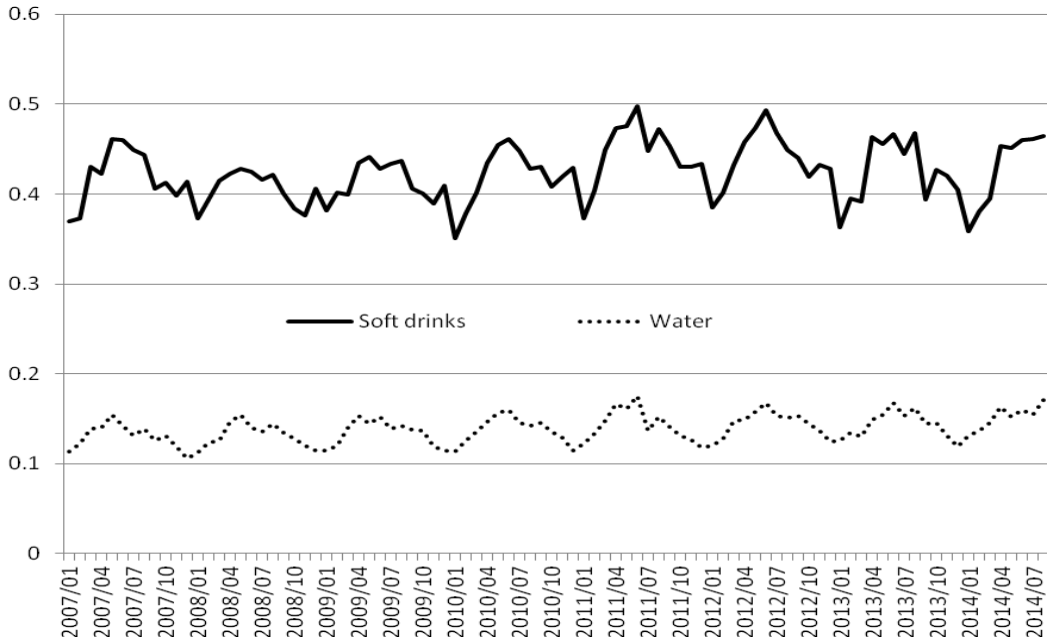
Source: Compiled using information from the EMIM published in the BIE by INE

1.3. Climate and economic variables that explain beverage sales

Given that soft drinks and water play a major role in beverage sales (measured in liters), we will focus on the sales of these two products.[3] At the end of the day, these two products explain the majority of the variations in the sales of non-alcoholic beverages in the country.

Before continuing, it is important to review the sales of these products, removing the effects of population growth and the variation in the number of days in different months. This is why it is preferable to focus on average daily sales (in liters) of soft drinks and water, respectively, per person in the country. Figure 4 highlights the evolution of these sales. We can see that, over the past number of years, the average sales of soft drinks per person has fluctuated between 350 and 500 milliliters per day, in accordance with a cyclical sales cycle. The sales of water have fluctuated between 100 and 180 milliliters per day.

Figure 4. Average Daily Sales of Soft Drinks and Water per Person (liters)



Source: Compiled using information from the EMIM published in the BIE by INEGI.

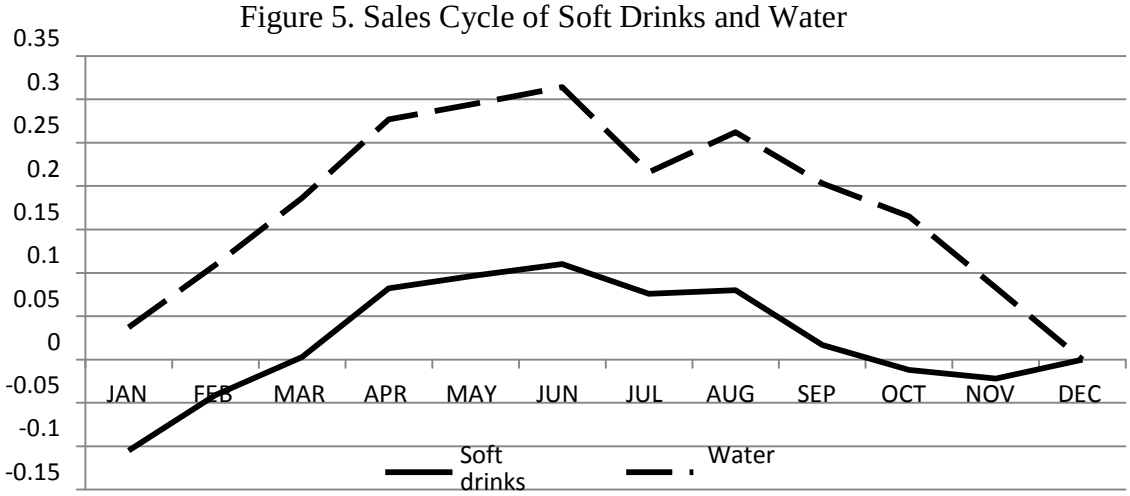
[3] Statistical tests using the sales of juices led to very poor results (i.e., seasonal and economic variables did not explain variations in the sales of juices).

Unlike the series found in Figure 3, which demonstrate a slight upward trend, the series in Figure 4 are relatively flat. Although, statistically speaking, we cannot discard the fact that there is a small upward trend in the sales of water, a large part of the growth seen in both the sales (in liters) of soft drinks and water, as seen in Figure 3, can be explained simply by population growth.

Based on a series of econometric exercises that will be explained in greater detail in Chapter 4, we can establish certain relationships between the sales of beverages per capita and some climate and economic variables. Firstly, the sales of soft drinks and water follow a climate-seasonal cycle; however, the cycle for each one of these products has its own peculiarities. Secondly, the sales of soft drinks are more sensitive to economic variables than the sales of water. This means that the sales of soft drinks depend on economic activity in general as well as their own price. Thirdly, the tax on sugary drinks led to a reduction in the sales of soft drinks of between 3 and 4.3%, but, as is to be expected, it had no impact whatsoever on the sales of water. Fourthly, there is an upward trend, although small, in sales of water.

Figure 5 shows seasonal cycles for the average number of liters of soft drinks and water sold per day in the country. In both cases, the benchmark is the month of December. For example, the sales of soft drinks in the month of January tend to be approximately 10% lower than in December. Similarly, sales of water in the month of June tend to be 30% higher than in the month of December. As we can see, both the sales of soft drinks and the sales of water increase in the warmest months and decrease in the coldest months. As such, we can say that both cycles are synchronized.

Figure 5. Sales Cycle of Soft Drinks and Water



Source: Created by the authors using results from the econometric exercises in Chapter 4.

There are several differences between the sales cycles of soft drinks and water that are worthwhile mentioning. On the one hand, the cyclical variations in the sales of water are greater in percentage terms than the cyclical variations in the sales of soft drinks. On the other hand, there is a consistent drop in the sales of soft drinks in the month of January, a behavior which is not observed in the sales of water. This phenomenon could be related to diets or New Year's resolutions. In other words, the lowest point in the cycle of the daily sales of soft drinks is found in January, while the lowest point in the cycle of the daily sales of water in December.[4]

The sales of soft drinks (per person) depend on both the intensity of the economic activity recorded in the country and on the price of the good itself. In particular, the econometric exercises we conducted indicate that the sales of soft drinks respond positively to the general economic activity found in the country. To be more precise, the income elasticity of soft drinks is 0.28 (i.e., the sales of soft drinks increase a little over a quarter of a percentage point when economic activity increases by a full percentage point). Although this number is relatively low, it remains consistent with the idea that soft drinks are normal

[4] The original series for the sales of soft drinks (in thousand liters) found in the EMIM has its lowest point in the month of February; however, it is important to take into consideration that February is a month that has 28 or 29 days, while January has 31 days. This is why it is no surprise that daily sales in January are lower than in February.

goods. On the other hand, the exercises also allow us to estimate that the price elasticity for the demand of soft drinks is 0.25. This means that the sales of soft drinks drop by a quarter of a percentage point when the price of soft drinks increases by a full percentage point.

Finally, although the sales of soft drinks are still much higher than the sales of water, it is important to highlight that the sales of water demonstrate an increasing trend which is not found in the sales of soft drinks once population growth is taken into account. This means that the per capita sales of soft drinks have remained stable, while the per capita sales of water have grown over the last years.

2. Diagnosis of the non-alcoholic beverage industry in Mexico

This chapter contains a diagnosis of the non-alcoholic beverage industry in Mexico. Among other things, it analyzes the evolution of the industry's production, employment and productivity. Furthermore, it includes a long-term monitoring of the consumption of NAB and soft drinks in the country. Finally, a calculation is made on the impact that consumption of soft drinks has on obesity, in addition to the effect that this tax could have on tackling this problem.

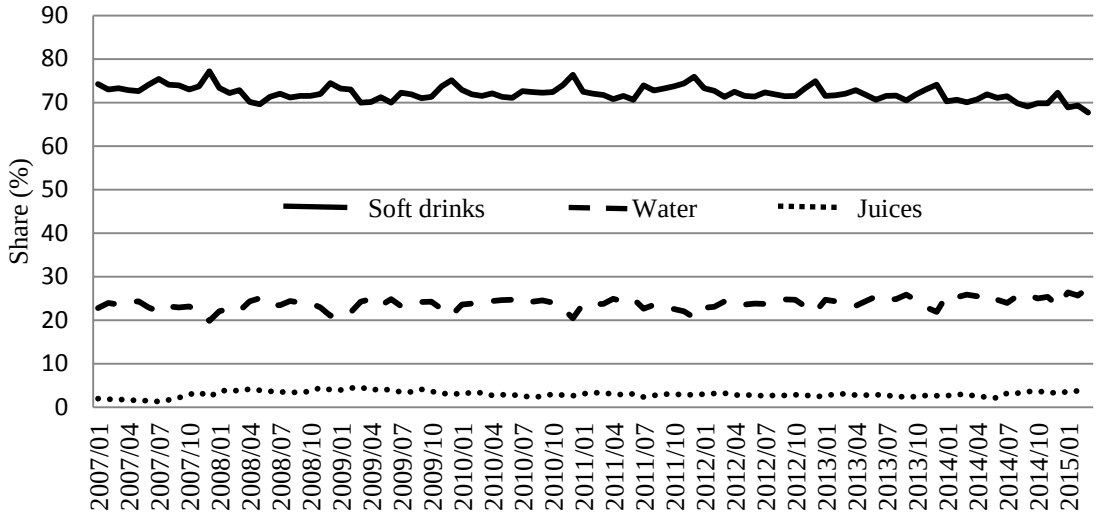
2.1. Non-alcoholic beverage production

The NAB industry represents 12.25% of total production of the food, beverages and tobacco industry and 2.39% of total production of the manufacturing industry in the country. This industry produces a whole range of goods, including: soft drinks, juices, bottled purified and sparkling water, powdered concentrates and energy drinks; however, as can be concluded from the previous chapter which studied household consumption, soft drinks, water (natural and sparkling) and juices represent almost the entire production and sales of NAB in the country.

One of the criteria used by the EMIM to define products within the NAB industry is that they must be ready to drink. For example, soft drinks, bottled water and juices usually meet this requirement; however, other beverages, such as coffee, tea, cocoa powder and powdered concentrates are, in the vast majority of cases, products that require preparation. That is why both the EMIM and other reports separate these types of goods. In accordance with this criterion and given its relevance, the diagnosis of the NAB industry focuses on three products: soft drinks, bottled water and juices.

Unlike other goods, such as alcoholic beverages or coffee, which have a major international presence, soft drinks, water and juices are mostly produced and sold within each country. Furthermore, their price is relatively stable over time and it is not competitive to maintain large stocks of these products. As such, it is to be expected that their production demonstrates a very similar pattern to sales. Figure 6 shows the share of the three most important products in the industry in terms of total production (measured in liters).

Figure 6. Evolution of the Share of Soft Drinks, Water and Juices in Total Production



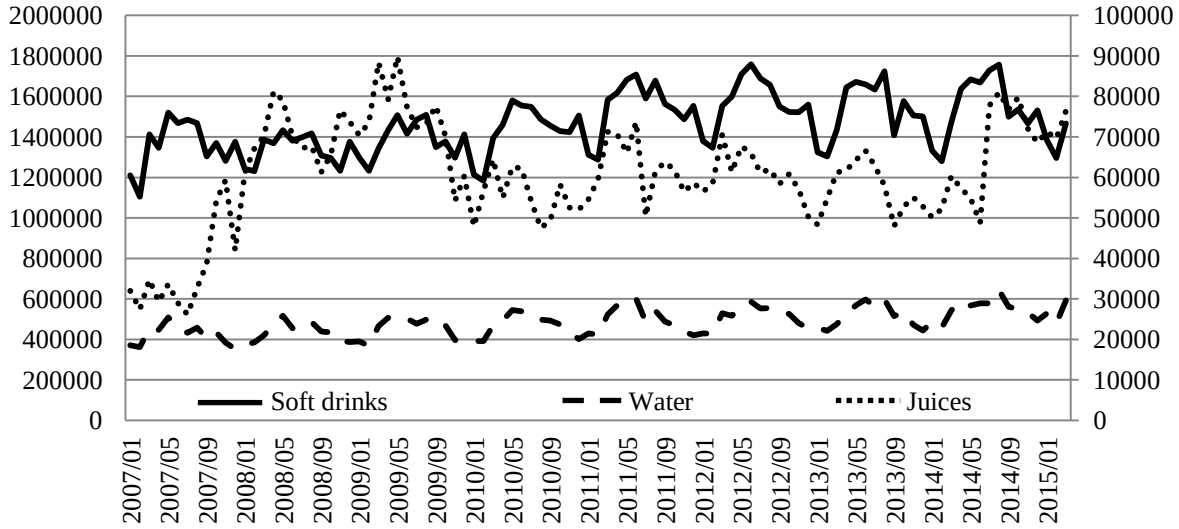
Source: EMIM, INEGI

Soft drinks have been the predominant product in the NAB industry; however, the share of bottled water in terms of total production has increased gradually. It is evident that changes in the habits of consumers, who are more and more focused on their health, have started to have an effect on the make-up of domestic production of non-alcoholic beverages.

Even though the *Euromonitor* industry report from March 2015 states that major generational changes are coming, as well as a shift towards the consumption of healthier beverages, the evolution of the production of both goods over the past number of years allows us to state that it will still take a considerable amount of time to significantly bridge the divide between the production of water and that of soft drinks.

The production of soft drinks, water and juices, just like the sales of these products, has seen sustained increases over time. Figure 7 shows the evolution of the domestic production of these goods over the past eight years. It is important to highlight that monthly production of soft drinks and water is measure along the main axis, while production of juices is measured along the secondary axis. The monthly production of soft drinks has fluctuated between 1.2 and 1.8 billion liters over this eight-year period. Similarly, we can see that production of water has fluctuated between 400 and 600 million liters. Finally, the production of juices has fluctuated between 30 and 90 million liters during this period.

Figure 7. Monthly Production of Soft Drinks, Water and Juices
(thousands of liters)



Source: EMIM, INEGI

If we compare monthly production at the beginning (January 2007) and the end of the period (January 2015), as shown in Figure 7, we can see the following percentage increases in each one of the products. The production of soft drinks increased from 1,200 to 1,400 million liters per month (i.e., production increased by approximately 16%). The production of water increased from 400 to 500 million liters, meaning an increase of 25%. Finally, the production of juices increased from 30 million to 75 million liters, the equivalent of an approximate increase of 150%.

The soft drink market can be classified as a mature one; that is, it is a market with a low and stable growth rate. The most important companies on the market have consolidated their positions over the years. In contrast, the water and juice markets are relatively small but demonstrate high growth rates. In these markets, we can still see a certain influx and efflux of relatively major players. Below is a more detailed description of characteristics and recent trends in each one of these markets.

The Soft Drink Market

Information from *Euromonitor* (2015) indicates that two companies in the country are responsible for 85% of the total sales of soft drinks. These companies are *Coca-Cola de México* and *Pepsi-Cola Mexicana*. *Coca-Cola de Mexico* is the market leader in soft drinks in the country with a market share of 68%. Furthermore, there have been no major changes in the market shares of the largest companies over the past eight years.

The compound annual growth rate for the production of soft drinks between 2007 and 2014 was 1.9%. Even though this rate is relatively low compared to other non-alcoholic beverages, the compound annual growth rate for soft drinks manufactured using sugar substitutes (also called diet soft drinks) was 6.3% for the same period. As such, we can clearly see that there is a growing interest among consumers for low-calorie beverages.

Forecasts for the next four years indicate that the industry will grow by a compound annual rate of 1%. These forecasts take into consideration no further shifts in fiscal policy that directly affect the soft drink market. As explained earlier, the IEPS had a negative effect on the growth rate of the industry. This tax was passed on to consumers, leading to price increases of between 7% and 12% in the majority of products; however, it is expected that low-calorie soft drinks, which are not affected by the tax, will grow by an annual rate of 7% during the same period.

It is expected that consumer habits will continue to change over the next five years, further affecting soft drinks that are considered to be products with high sugar content. This is why the soft drink industry needs products that consumers perceive to be healthy and low in calories. As the figures clearly show, the industry has searched for and implemented innovations in its products in order to meet these consumer demands. For example, in 2014, Coca-Cola launched a cola drink sweetened using stevia.

The Juice Market

According to information from *Euromonitor* (2015), the market is made up of 30 companies, 17 of which are part of the domestic juice industry in Mexico; however, three of these companies are responsible for 67.5% of this industry's production. These companies are *Jugos del Valle, Jumex* and *Grupo Lala*. Competition in the juice market is fiercer than in the soft drink market. *Jugos del Valle* has led the market for the past 6 years. In 2014, this company was responsible for 25.8% of production, followed by *Jumex* with 23.2% and *Grupo Lala* with 9.5%.

It is important to mention that *Jugos del Valle* is a subsidiary of *Coca-Cola México* and, as such, has major advantages in terms of negotiations and distribution channels for its products. Over the past 6 years, there have been practically no changes in the market share of the 17 domestic companies, with the exception of *Aje Group*. This company increased its market share from 4.5% to 5.7% between 2009 and 2015. During 2014, a number of products offering a combination of milk and juice were launched by *Del Valle* and *Jumex Fresh* (a commercial partnership between Pepsi and *Jumex*).

The *Euromonitor* report (2015) indicates that, despite the new IEPS, the production volume of juices increased by 2% during 2014. This led to a compound annual growth rate for juice production of 4.6% between 2009 and 2014. This figure reflects the significant growth seen in the juice industry, driven by consumers wanting to purchase healthy products, over the past number of years; however, it is important to mention that although juices are seen as being healthy products, some of them have high sugar and calorie content. As such, companies within the sector are coming up with products that are less processed and sweetened, trying to create the most natural concentrate possible.

The IEPS had a moderate effect on the juice industry as a result of the variety of different product sizes available. The average price of juices increased between 5 and 7%. This figure is substantially lower than that of soft drinks. The increase in the average price of juices exempt from the tax, i.e. those with low sugar content (usually referred to as diet), was only 2.5%

Despite the tax, *Euromonitor* (2015) forecasted that the production and sale of juices will reach a compound annual growth rate of 4% over the next four years. This figure is exceedingly high compared to the growth expectations for soft drinks; however, it is relatively low if compared to the growth expectations for diet soft drinks, not to mention the relatively small size of the juice market. As such, we can say that the juice industry is also facing the challenge of innovation in its products in order to make them healthier while maintaining the natural properties of the fruit being used.

The Bottled Water Market

The bottled water market is characterized by the vast number of companies competing within the industry. To be more precise, there are more than 30 national brands and 100 regional brands in the country; however, 3 brands from different companies represent 70% of the market's sales volume. These brands are *Bonafont, Ciel* and *Epura*, ranked in order of their market share. *Bonafont* is owned by *Danone, Ciel* by Coca-Cola and *Epura* by Pepsi. This ranking, in terms of market share, has remained stable over the past 5 years.

The average per capita water consumption in the country is 163.5 liters. Bottled water production increased by 6% in 2014. This industry has experienced one of the highest growth rates in the NAB industry. The compound annual growth rate for the period comprising 2007 to 2014 was 4.3%. Although this figure is slightly below that reported for juices, it is important to highlight the fact that the production of bottled water is much higher than that of juices.

A major portion of sales of bottled water are a result of the demand for water jugs. These products are particularly necessary for homes and geographic areas in the country where there is no safe drinking/potable water. Water jugs represent 70% of the sales of bottled water.

According to *Euromonitor* (2015), the bottled water market has not yet matured. This market has grown continually since the 1990's, and it is expected that it will continue to grow for at least 5 years more. As manufacturers of soft drinks and juices drive innovation in the low-calorie beverage market, the bottled water market will face greater competition from these products and will have to find stability

2.2. Evolution in the consumption of non-alcoholic beverages

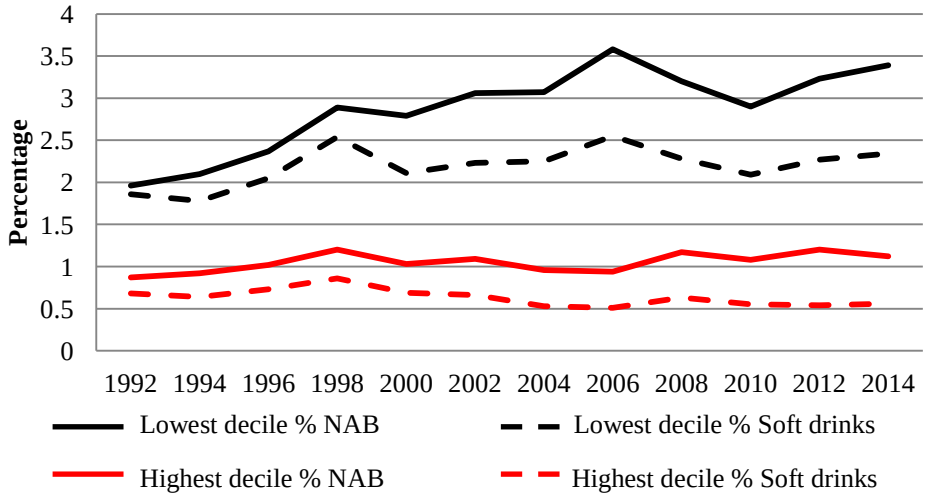
Mexico is one of the countries with the highest per capita consumption of soft drinks in the world. According to *Euromonitor* (2014), average consumption stands at 119 liters per person per year.[5] Figures from the EMIM show us that this is not a recent phenomenon given that both production and sales have remained stable over the past number of years. This is one of the reasons why it is interesting to analyze the consumption of non-alcoholic beverages, especially soft drinks, over the course of a number of decades.

Information from the ENIGH allows us to study the consumption of beverages from 1992 to 2014. Based on the data from the ENIGH, a series was created to help us track household spending on NAB and soft drinks (Ref.) as a proportion of total spending over the last number of decades. This information provides us with an insight into any major changes in the consumption of NAB and soft drinks that reflect a long-term trend.

In order to be able to distinguish between households based on income level, 10 groups were created based on their monetary spending. Each group is divided into a decile comprising 10% of the households in question. The lowest decile corresponds to those households with the lowest monetary spending (the poorest 10% in the country). Meanwhile, the highest decile corresponds to those households with the highest level of monetary spending (the richest 10% in the country). Figure 8 shows the evolution of spending on NAB and soft drinks, respectively, as a percentage of the total spending of the two groups mentioned above.

[5] This figure implies daily consumption of 326 milliliters. This is slightly less than the estimated 350-500 milliliters based on information from the EMIM and population growth projections.

Figure 8. Evolution of NAB and Soft Drinks as a Proportion of Total Spending



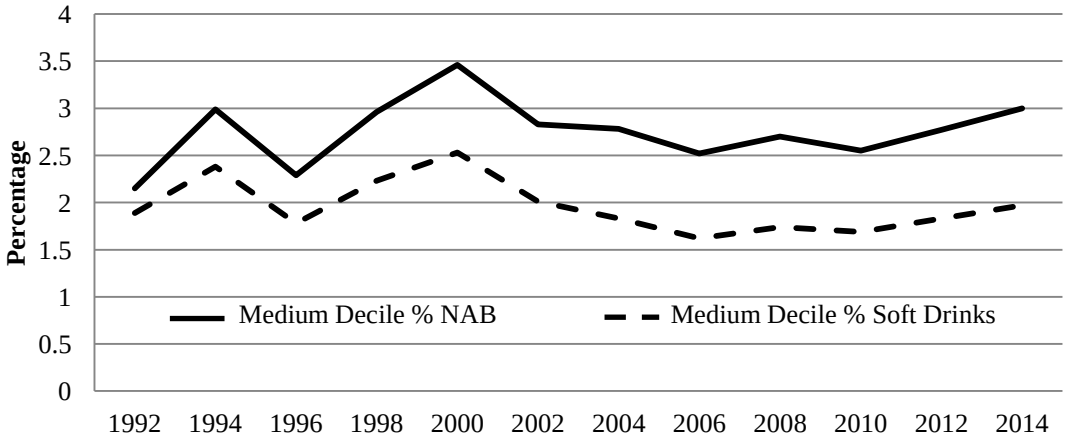
Source: ENIGH, INEGI

There are a number of things that we can discuss regarding the evolution of spending on NAB and soft drinks over the past number of decades. As we mentioned in the previous chapter, the poorest households (in this case, the lowest decile) tend to assign a much higher proportion of their spending to the consumption of NAB and soft drinks than the richest households (in this case, the highest decile). This situation has not changed over time. For example, as we can see in Figure 8, the poorest households earmarked between 2% and 3.5% of their spending on NAB between 1992 and 2014. During this same period, the richest households only earmarked around 1% on purchasing the same products. Something similar can also be seen with soft drinks.

Other important aspects of the trends found in the consumption of NAB and soft drinks over the long term are the following. Firstly, the proportion of spending earmarked by the poorest households on the consumption of NAB has grown significantly, while this proportion has only increased moderately among the richest households. For example, spending by the lowest decile on NAB as a percentage of total spending increased from 1.96% in 1992 to 3.39% in 2014. In contrast, the proportion of spending on NAB by the highest decile increased from 0.87% in 1992 to 1.12% in 2014. Secondly, the proportion of spending earmarked by the poorest households on the acquisition of soft drinks grew moderately while this proportion dropped slightly among the richest households. To be more precise, soft drinks expenditures as a proportion of total spending among the poorest households increased from 1.86% in 1992 to 2.34% in 2014. The figures corresponding to the richest households were 0.68% in 1992 and 0.56% in 2014.

Figure 8 clearly demonstrates how the divide between soft drinks and NAB has widened over time, especially among the poorest households. This means that, at the beginning of the 1990's, when soft drinks represented almost the entirety of NAB consumption, over time other products have gained ground. Nevertheless, the proportion of spending on soft drinks has remained relatively stable over the past number of years among both the poorest and the richest households.

Figure 9. Evolution of NAB and Soft Drinks as a Proportion of Total Spending



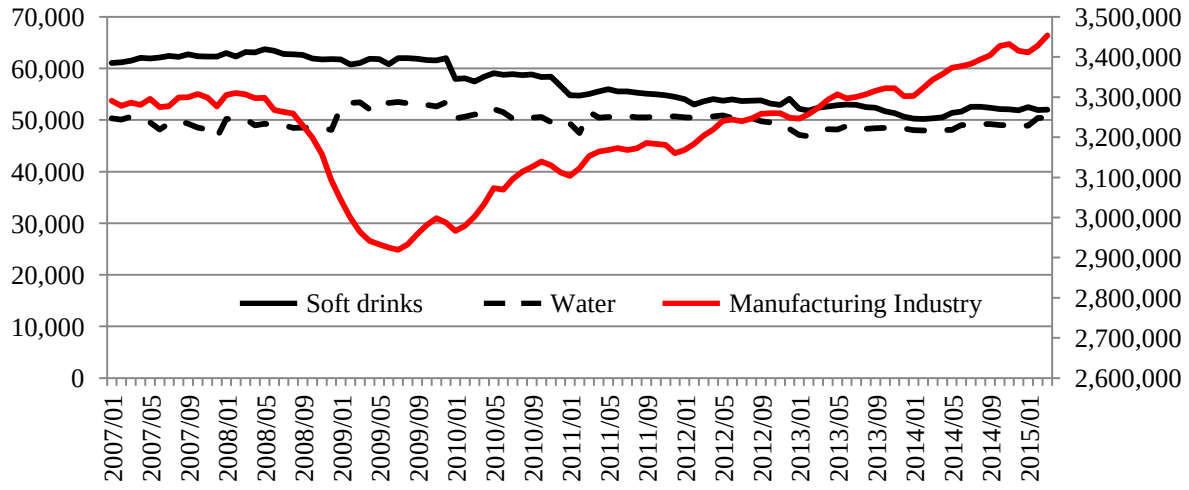
Source: ENIGH, INEGI

As there are a number of differences in the evolution of consumption among the lowest and highest deciles, it interesting to review the behavior of a medium decile (for example, decile 5). Figure 9 shows the participation of NAB and soft drinks in terms of total spending in the medium decile. It should be mentioned that, as was seen among the lowest and highest deciles, there is a growing divide between spending on NAB and soft drinks; however, we should mention that the consumption of NAB has increased at no detriment to the consumption of soft drinks.

2.3. Employment in the non-alcoholic beverage industry

The non-alcoholic beverage industry provides employment for more than 100,000 people. Around half of these people are directly involved in the production of soft drinks and the rest in the production of water, juices and other NAB. According to figures from the EMIM, the people employed by the NAB industry represent approximately 3% of the total people employed in the manufacturing industry.

Figure 10. Employment by Industry

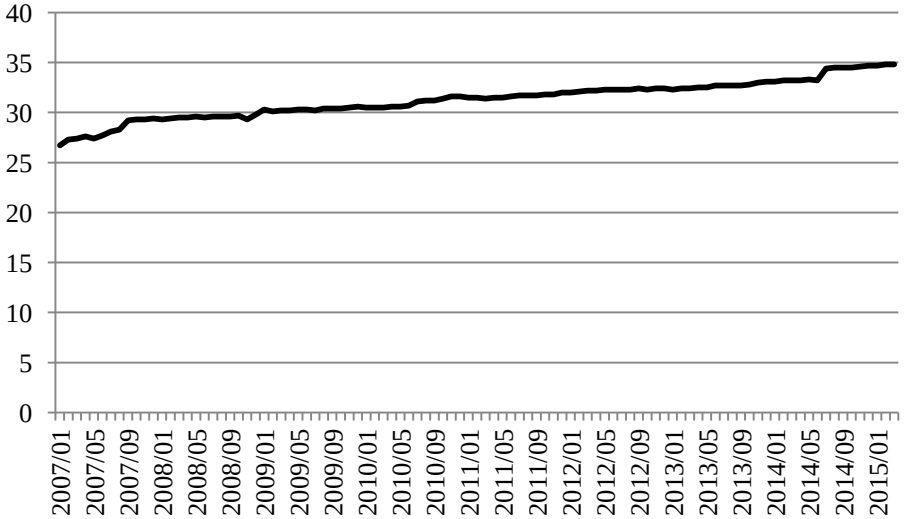


Source: EMIM, INEGI

Although the NAB industry is part of the manufacturing industry, its behavior is not similar in terms of employment. As can be seen in Figure 10, the NAB industry is a very stable industry which focuses mainly on the domestic market. Unlike the situation in the manufacturing industry, employment in the soft drink and water industries did not fall significantly during the international economic crisis of 2008; however; employment in these industries did not bounce back after the crisis as was the case with employment in the manufacturing industry.

The solid black line in Figure 10 shows the evolution of the number of employees in the soft drink industry. It is evident that there is a downward trend in terms of the number of people being employed in this industry. Given that the production of soft drinks has increased over the past few years, the decreasing employment trend highlights how productivity in the industry has increased dramatically. According to research documents published by ANPRAC (2014), covering the workforce and productivity within the NAB industry, specifically the soft drink industry, the technology used in its production processes has been gradually replacing the workforce. Real productivity has increased significantly over the past 15 years. It is important to highlight that the number of employees shown in Figure 10 encompasses only those involved in production and not those involved in administrative areas.

Figure 11. Average Production per Worker in the NAB Industry

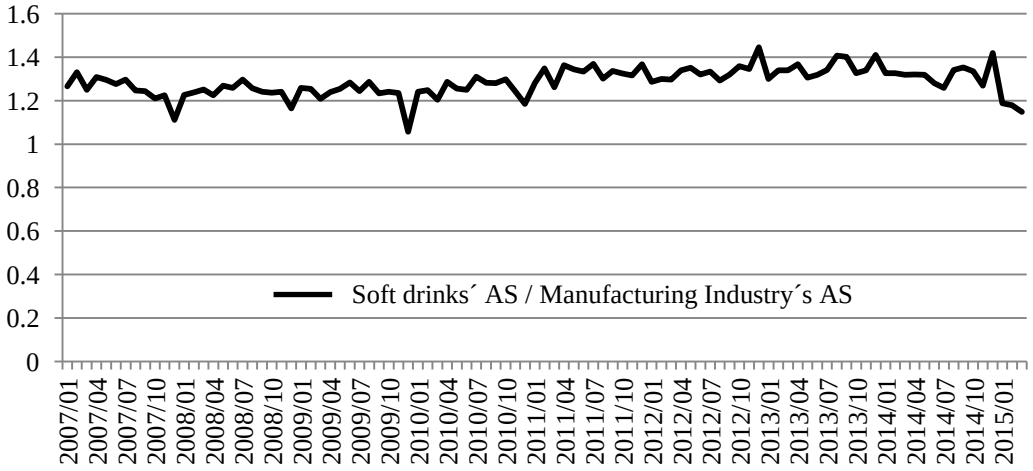


Source: EMIM Survey.

Figure 11 shows the evolution of average production per worker within the NAB industry. It is clear that there has been significant growth in terms of productivity in the industry in general. Given the importance of the soft drink industry, productivity in the NAB industry reflects the performance of the soft drink industry itself. To be more precise, productivity in the NAB industry experienced a 40% increase between 2007 and 2015, while productivity in the soft drink industry increased by 45% during the same period. Nevertheless, given the similarity in the growth rates, the pattern of replacing the workforce with technology is similar in the soft drink, juice and bottled water industries.

There are major differences between the average salaries of the employees of the different industries which form part of the NAB industry. According to the EMIM, the average salaries in the bottled water industry stand at $4,584 pesos, while those in the soft drink industry reach $11,863 per month.

Figure 12. Average Salaries (Soft Drinks Industry vs. Manufacturing Industry)



Source: IMIM Survey.

Average salaries among workers in the soft drink industry are substantially higher than in the manufacturing industry. Figure 12 shows the relative evolution of average salaries in the soft-drink and manufacturing industries. As can be seen, relative salaries have fluctuated between 1.2 and 1.4 over the past number of years. This means that the average salary of workers in the soft drink industry has consistently been 20% higher than in the manufacturing industry; however, salaries in the soft drink industry are not growing faster those in the manufacturing industry.

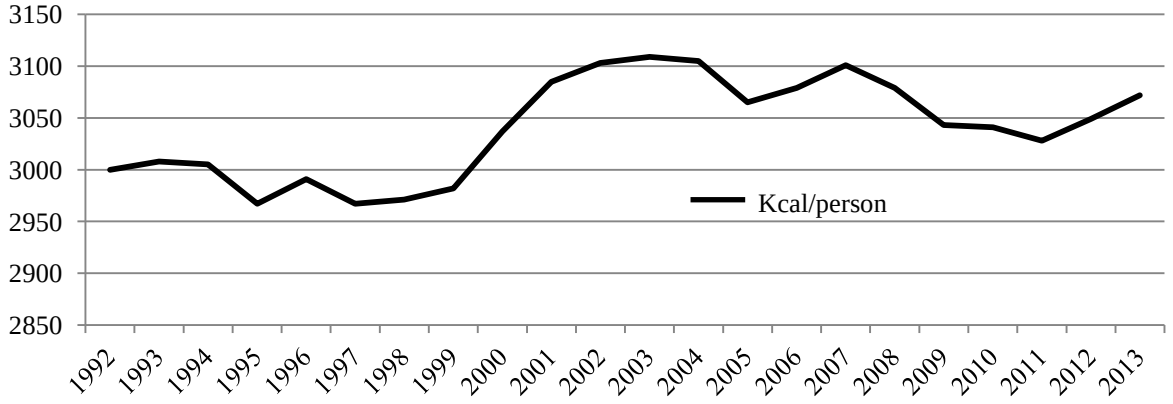
2.4. Contribution of soft drinks to obesity

In 2014, a special tax on sugary drinks came into effect. The tax was justified as a public health measure. It was argued that the tax would help reduce the consumption of a series of beverages that, given their caloric content, could be deemed to be the cause of obesity in Mexico. As we explained earlier, the most widely-consumed beverages in Mexico are soft drinks, water and juices, in that order. As such, the tax was focused mainly on soft drinks.

As Wright and Aronne (2012) explain, a number of studies show that obesity is a multifactorial problem which combines eating habits, lifestyle, genes and physical exercise, among others. Keith et al. (2006) explain that the lack of exercise and the abundant availability of food are considered to be the two main factors that cause obesity; however, they state that there are other factors that also contribute to obesity, such as a reduction in the number of hours of sleep, temperature changes (due to the use of air conditioning), a reduction in the number of cigarettes being smoked, an increase in the use of medication (for example, anti-depressants), and many others. That is why it is difficult to expect a tax aimed at a specific product to lead to significant reductions in obesity.

Some figures can help to calculate the contribution of the consumption of soft drinks to the problem of obesity in the country. As was mentioned above, *Euromonitor* (2014) estimates that the per capita consumption of soft drinks in Mexico stands at 119 liters per year. This means that the daily average consumption in the country is around 326 milliliters per day. Some of the authors' estimations, using data from the EMIM, show that the average daily consumption of soft drinks is a little higher, fluctuating between 350 and 500 milliliters, depending on the weather conditions. Supposing that all of the soft drinks consumed in the country corresponded to those with the highest caloric content (i.e., supposing that no consumers drank diet drinks), and taking into consideration, as an extreme example, the average consumption of soft drinks, this would only, at the very most, contribute with 210 calories to the daily diet of people in Mexico.

Figure 13. Daily Kilocalories per Person in Mexico



Source: FAOSTAT (2015).

According to information from the FAOSTAT (2015), average calorie intake in Mexico stands at 3,024 kilocalories per day; however, the WHO (2013) recommends a daily intake of 2,000 kilocalories. As such, the average person in Mexico consumes 1,024 kilocalories above the amount stipulated by the WHO. Figure 13 shows that average calorie consumption in Mexico has remained above recommended levels for a number of decades. The caloric intake of soft drinks is contributing no more than 7% of the kilocalories ingested by an average person in Mexico and 20.5% of the excess kilocalories (i.e. those above the levels recommended by the WHO). Even if we completely eliminate the consumption of soft drinks, and supposing that these were not substituted by other products, the diet of the average Mexican would greatly exceed international recommendations. The consumption of soft drinks is therefore not the leading cause of obesity in the country.

Although there are a number of estimates regarding the effect that the tax on sugary drinks has had on the sales of soft drinks, the most reasonable of these show a decrease in the consumption of soft drinks of 3%.[6] Even in the extreme case that the average consumption of soft drinks reached 500 milliliters per day, the reduction in levels of consumption as a result of this tax would only represent 15 milliliters per day. As such, the tax, in the best case scenario, led to a decrease in average daily intake of 6.3 kilocalories. In other words, the tax led to a reduction in average kilocalorie intake (supposing that soft drinks were not substituted by other products) of 0.21% and approximately 0.62% of the excess kilocalories consumed by people in Mexico.

[6] The effects of the tax are analyzed in Chapter 4.

3. Characterization of the non-alcoholic beverage industry in Mexico

This chapter provides further information about the NAB industry in Mexico. In order to characterize the industry, we must first clearly define the activities found within it. Later, we will explain the way in which the NAB industry is related to other industries. We will then calculate and analyze the NAB industry´s output, income and employment multipliers of the Mexican economy. Subsequently, we will estimate the contribution made by this important industry to the economy of the country. Finally, we will compare the NAB industry with other economic activities.

3.1. Analysis of the activities in the non-alcoholic beverage industry

Before characterizing the Non-Alcoholic Beverage Industry in Mexico, it is important to explain how economic activity is classified in the national statistics and what activities the industry comprises.

After the signing of the North American Free Trade Agreement (NAFTA), the economic activities of member countries were classified using the North American Industry Classification System (NAICS). This homogenous system applied to the statistics of Mexico, the United States and Canada helps more accurately identify the trade relations between the three countries. The 2007 version of NAICS identifies 20 sectors, 94 subsectors, 304 branches of economic activity, 617 sub-branches and 1,049 classes. Each sector, subsector, branch, sub-branch and class corresponds to a number: sectors have two-digit numbers, subsectors have three-digit numbers, branches have four-digit numbers, sub-branches have five-digit numbers and classes have six-digit numbers.[7] For illustration purposes, we will include in parenthesis the number corresponding to each industry along the document.[8]

According to NAICS, the beverage industry (3121) belongs to the subsector of the beverage and tobacco industry (312), while this subsector pertains to the

[7] This information was obtained from the following website: http://www.inegi.org.mx/sistemas/NAICS/contenidos/Contenidos/FAQ.aspx?c=76016#qs1

[8] Appendix A.3.1 includes a list of NAICS codes and the corresponding description of the branches of economic activity mentioned in the study.

manufacturing sector (31). The beverage industry (3121), meanwhile, is separated into the sub-branches of non-alcoholic beverages (31211) and alcoholic beverages (31212-4). Sub-branch 31211 in the NAICS catalog is entitled: the elaboration of soft drinks, ice and other non-alcoholic beverages, and the purification and bottling of water. In this chapter, we have referred to this as "non-alcoholic beverages".

3.2. Structural analysis of the non-alcoholic beverage industry

The Input-Output Table (IOT) is a database that describes purchases and sales between different economic sectors within a region or country. If we look at purchases, the IOT offers an insight of the primary and intermediate inputs required by each economic sector in order to produce goods or services. Similarly, if we look at sales, the IOT provides information about the way in which intermediate or final goods produced by each sector are allocated in the economy.[9] In this document, we analyze the 2012 IOT. This is an updated version of the domestic 2008 IOT recently published by the INEGI.

3.2.1. Non-alcoholic beverage industry´s cost structure and output allocation

Based on information from the 2012 IOT, it is possible to identify the cost structure and output allocation of the NAB industry. These two things are described below.

Cost structure of the NAB industry

The NAB requires two types of inputs: intermediate and primary. Intermediate inputs are products sold by other industries. For example, the NAB industry purchases intermediate inputs such as sugar, dyes or containers produced by other economic sectors. Primary inputs are capital and labor. For example, in the NAB industry equipment (which is called capital) is needed to pump liquids into the containers and workers are needed to operate this

[9] Appendix A.3.2 includes a more detailed description of the IOT.

equipment. Therefore, intermediate inputs are transformed with the use of work and capital into other intermediate or final goods. This is why primary inputs add value to intermediate goods. Inputs can be sourced domestically or from outside the country (imported). Furthermore, the NAB industry must pay taxes to the government in order to be able to sell its products. The sum of the purchase of intermediate inputs, the payment to primary inputs and taxes (subtracting any subsidies) is what is called gross output.

Table 3. Cost structure of the Non-Alcoholic Beverage Industry

Inputs used by the Non-Alcoholic Beverage Industry	**Percentage of Gross Output**
EBO	27.21%
M	13.41%
REM	10.02%
3119 Oher food industries	8.53%
3261 Manufacturing of plastic products	6.41%
31131 Sugar	6.35%
4311 Wholesale grocery and food	6.18%
3114 Preservation of fruit, vegetables and prepared food	3.70%
2221 Water collection, treatment and supply	3.11%
3272 Manufacturing of glass and glass products	1.95%

Source: calculations made by authors based on 2012 National MIP, INEGI.
NB: REM=payment for work or wages. EB0= payment to capital or gross operating surplus. M=imported intermediate inputs. T1 = taxes on production minus subsidies (takes into consideration mostly payroll and property taxes).

The IOT enables us to analyze the cost structure or input requirements of the NAB industry. Theoretically, this pattern is known as the production technique. Table 3 shows the cost structure of the NAB industry. Given space limitations, this table shows only the ten most important inputs purchased by the NAB industry.

According to data from the IOT, approximately half (50.64%) of the costs of the NAB industry (31211) correspond to payments to capital (EBO), workforce (REM) and imported intermediate inputs (M). The other half of the industry's costs corresponds to the purchase of domestically-sourced intermediate inputs from other food industries (3119), including producers of concentrates, powders, syrups and flavor essences for beverages; the manufacturing of plastic products (3261); sugar production (31131); wholesale grocery and

food (4311); the preservation of fruit, vegetables and prepared food (3114); water collection, treatment and supply (2221); and the manufacturing of glass and glass products (3272).

Output allocation of the non-alcoholic beverage industry

In very general terms, an industry can sell its output as an intermediate input to another industry, or as a final product to families, to the government or the external sector. Similarly, the industry can sell its output to other companies as a capital good or to maintain stock (investment). As such, the sales pattern of the Non-Alcoholic Beverage industry reflects the way in which its gross output is distributed among its buyers.

According to data from the IOT, the Non-Alcoholic Beverage industry produces mostly final goods. Private consumption accounts for 95.54% of the industry's total value of production. As such, households are the major buyers of this industry (Table 4).

Table 4. The Non-Alcoholic Beverage Industry´s output allocation

Output allocation of the BNA industry		**Intermediate Demand**	**4.46%**
	Main sectors supplied by the non-alcoholic beverage industry	7221 Full-service restaurants	26.98%
		4311 Wholesale grocery and food	15.01%
		5221 Commercial banking	10.47%
		7222 Self-service restaurants, takeaway food and other limited-service restaurants	7.34%
		1141 Fishing	7.15%
		Non-alcoholic beverages	6.38%
		7223 Caterers	5.79%
		Final Demand	**95.54%**
	Components of final demand	Private consumption	96.45%
		Inventory variation	0.18%
		F.O.B exports	2.72%
		Statistical discrepancy	0.65%

Source: created by the authors based on the 2012 National MIP, INEGI.

The remaining 4.46% of the gross output is sold as an intermediate input to other economic sectors, such as full-service restaurants (7221), wholesale grocery and food (4311) and commercial banking (5221), among others.

3.2.2. Output allocation of the NAB industry´s suppliers

After identifying the major suppliers of the non-alcoholic beverage industry, it is important to ask ourselves how relevant this industry is for them. One measure of the importance of the Non-Alcoholic Beverage industry for a specific supplier is the contribution of the industry's purchases to the supplier's gross output. Table 5 contains this information.

Table 5. Weight of NAB Industry´s purchases on its Main Intermediate Input Suppliers´ gross output

Economic Activities	**Non-Alcoholic Beverages (31211)**
3272 Manufacturing of glass and glass products	5.37%
31131 Sugar	17.55%
3324 Manufacturing of boilers, tanks and metallic containers	3.79%
3119 Other food industries	9.04%
2221 Water collection, treatment and supply	7.03%
3114 Preservation of fruit, vegetables and prepared food	7.49%
5418 Advertising services and related activities	3.29%
3112 Milling of grains and seeds for oils and fats	0.83%
3261 Manufacturing of plastic products	4.66%

Source: created by the authors based on the 2012 National MIP, INEGI.

The Non-Alcoholic Beverage industry is a major buyer of the sugar industry (31131), other food industries (3119), the preservation of fruit, vegetables and prepared food (3114), the collection, treatment and supply of water (2221) and the manufacturing of glass and glass products (3272).

3.3. Output, income and employment multipliers of the NAB industry

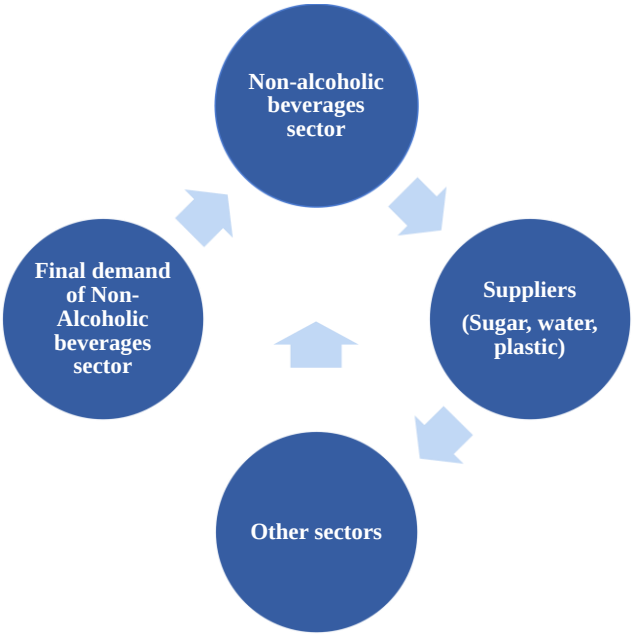
In this section, we will calculate and analyze output, income and employment multipliers of the Non-Alcoholic Beverage Industry. The technical details regarding how these multipliers are calculated can be found in Appendix A.3.3.

3.3.1. Output Multipliers

Output multipliers can be calculated using Leontief's Open Model. These can be categorized into two types: output multiplier and the multiplier for a uniform expansion of final demand. Each of them provides a measure of interdependency between a particular industry and the rest of the economy. The output multiplier computes the effects of an exogenous change in the final demand for the output of industry j, through the direct and indirect purchases of intermediate inputs of this industry; therefore it is an indicator of the total backward linkages of industry j with the rest of the economy. On the other hand, the multiplier of a uniform expansion of final demand considers the effect that a $1 million pesos increase in the final demand for all goods has on the output of industry j, given that this industry is a direct and indirect supplier of intermediate inputs in the economy. Hence this multiplier is an indicator of the total forward linkages of the sector j (see Figure 1).

The output multiplier can also be interpreted in the following way. Suppose that the demand for non-alcoholic beverages increases by one million pesos. This has an immediate impact on the sectors from which the non-alcoholic beverage industry directly purchases its intermediate inputs (e.g., the sugar industry). As such, these sectors will demand more of the inputs they require to provide their products to the NAB industry (for example, the sugar industry will buy from the crops sector) and so on. As a result, the one million pesos increase in demand for non-alcoholic beverages leads to an increase in the total value of production of more than one million pesos. This is due to the fact that demand for NAB drives the production of the economic activities that directly or indirectly supply intermediate inputs to this industry.

Figure 1. Relationships considered in the calculation of the Output Multiplier of the NAB Industry



Source: made by the authors.

Table 6 shows the non-alcoholic beverage industry's multipliers. As can be seen, the output multiplier is 1.76. This multiplier can be interpreted in the following manner. In the event of a one million peso increase in demand for non-alcoholic beverages, the total value of production in Mexico increases by $1.76 million pesos. Of this total, $1 million corresponds to the initial increase in demand for non-alcoholic beverages and the remaining $0.76 million corresponds to the purchase of intermediate inputs from indirect supplier

The multiplier of a uniform expansion of final demand (UEFD) quantifies the increase in the gross output of a specific activity in response to a uniform expansion in the demand for all final goods produced in the economy. Economic activities with large multipliers of this type are characterized as being major suppliers of intermediate inputs for the entire economy. As such, these activities could represent bottlenecks when their production is constrained.

Table 6. Output and UEFD Multipliers of the NAB Industry in Mexico

Non-Alcoholic Beverages	1.76	1.21	Expansion (backward)
Economy Average	1.47		

Source: created by the authors based on the 2012 National MIP, INEGI.

The NAB industry has a low UEFD multiplier given that it mainly sells goods to consumers. The interpretation of this multiplier is the following: in the event of a $1 million pesos increase in the demand for final goods in all economic sectors, the NAB industry's output increases by $1.21 million pesos, of which $1 million pesos corresponds to the increase in final demand and the remaining $210,000 pesos are a result of it indirectly supplying intermediate inputs to other economic activities.

According to Miller and Blair (2009) and given the multipliers obtained so far, the NAB industry can be classified as dependent on interindustry supply.[10] This industry has high backward linkages and low forward linkages.[11] It is an important direct and indirect buyer of intermediate inputs, and a supplier of final goods.

3.3.2. Income Multiplier

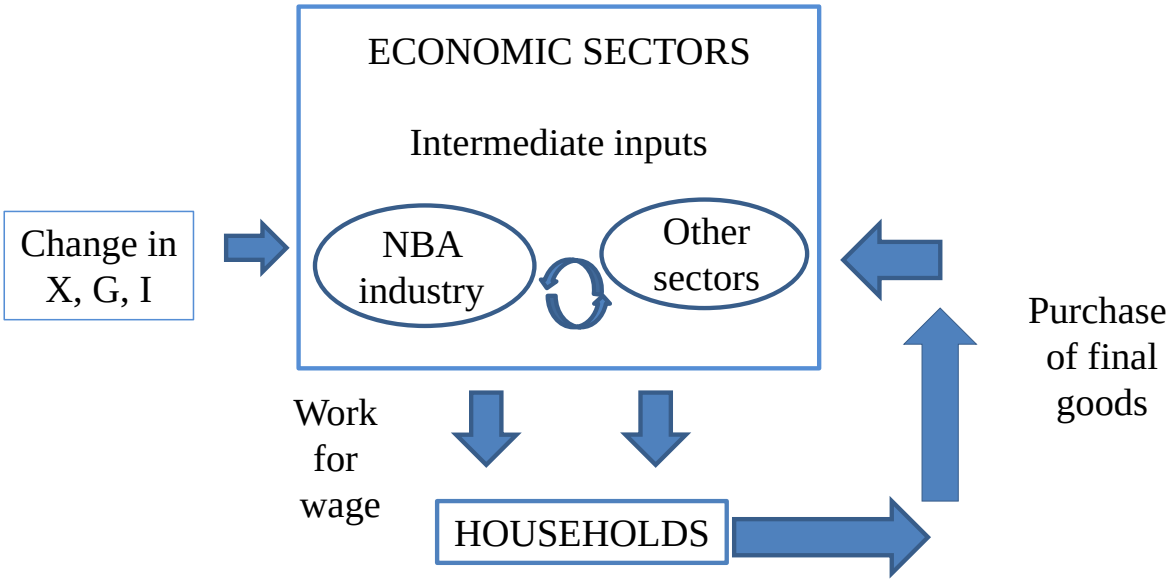
The income multiplier shows the effects on the economy of the relationship between industries, primary factors and households. In theoretical terms, this multiplier shows what is known as the circular flow of income. The multiplier was calculated with a Closed Input-Output Model; more information about this can be found in Appendix A.3.3.

[10] This classification can be found in Appendix A.3.4.

[11] Given that NAB industry sells goods to consumers, its UEFD multiplier is around 18% smaller than the average multiplier in the Mexican economy (1.21 compared to 1.47); however, the NAB industry is an important buyer of intermediate inputs. This is why its output multiplier is about 20% larger than the average in Mexico (1.76 compared to 1.47).

The income multiplier takes into account the following relationships and effects. For example, if exports of NAB increase, the NAB sector will demand more intermediate inputs from other sectors and more work from households. The sectors that supply these intermediate inputs to the beverage industry will, in turn, demand more inputs from other sectors, while households, with increased earnings, will demand consumer goods provided by the industries, which will, in turn, increase their demand for intermediate inputs and so on (see Figure 2).

Figure 2. Income Multipliers´s relationships



Source: made by the authors.

The NAB industry has an income multiplier of 2.28. This means that if exports increase by $1 million pesos, income in the Mexican economy will increase by 2.28 million pesos. One million pesos is due to the initial increase in exports while the remaining 1.28 million pesos are the direct, indirect and induced effects of the income-expenditure relationships between industries and households.

3.3.3. Employment Multiplier

The employment multiplier of a specific economic activity measures the effect that a particular increase in final demand for a given activity has on employment in the economy as a whole. In other words, this multiplier takes into account employment linked to the expansion in production given that it increases direct and indirect purchasing of intermediate inputs. The employment multiplier of the NAB industry is 2.94.

Table 7. Income and Employment Multipliers of the NAB Industry

Multiplier	**Multiplier**	
Income	2.28	Million pesos
Employment	2.94	Workers per million pesos

Source: created by the authors based on the 2012 National MIP, INEGI.

The multiplier can be interpreted in the following manner. Approximately 3 jobs are created when demand for the final goods offered by the NAB industry increases by $1 million pesos. Table 7 contains a summary of the income and employment multipliers of the NAB industry and their relation to the Mexican economy.

3.4. Contribution of the NAB industry to Mexico's gross output

The NAB industry was directly responsible for 0.61% of gross output in 2012 (see Table 8); however, by applying the input-output methodology, we can see that the activities of the NAB industry have a multiplier effect on the domestic economy due to interindustry relationships.

In order to determine the total contribution of the NAB industry to gross output, taking into account the aforementioned multipliers, we will use the hypothetical extraction method, which is described in more detail in Appendix A.3.5. Intuitively, this method estimates how much gross output in the country would decrease if the NAB industry didn't exist. As such, this method eliminates both purchases and sales from this industry.

The total contribution of the NAB industry to gross output, in terms of hypothetical extraction, is 1.07%. Comparing total contribution to direct contribution, we can identify that the indirect contribution of the NAB industry, as result of cross-sectoral sales and purchasing relationships, is 0.46%. These results are presented in Table 8.

Table 8. Contribution to Gross Output of the NAB Industry in Mexico, 2012

Beverage Industry	Direct Contribution	Indirect Contribution	Total Contribution
Non-alcoholic beverages	0.61%	0.46%	1.07%

Source: created by the authors based on the 2012 National MIP, INEGI.

3.5. Comparative analysis of the NAB industry with other sectors

This section compares output, income and employment multipliers of the NAB industry with other industries in its group. The industries that serve as benchmarks are: the manufacturing industry (31-33); the food industry; the beverage and tobacco industry (311-312); and the beverage industry (3121). A comparative analysis of the major divisions in productive activity is also presented.

The NAB industry has greater output, income and employment multipliers than those found in the manufacturing industry and the beverage industry. The greatest differences can be found by comparing the income and employment multipliers of the NAB industry with those of the manufacturing industry. The NAB industry has income and employment multipliers of 2.28 and 2.94, respectively, while the multipliers of the manufacturing industry are 1.87 and 1.60, respectively.

The food, beverages and tobacco industry has a greater multiplier effect on output and employment than the NAB industry; however, the NAB industry has a higher income multiplier (2.28 compared to 2.15).

An important point to make is that the NAB industry has greater output and income multipliers than the average of the Mexican economy. The output and income multipliers in the industry stand at 1.76 and 2.28, respectively, while the average multipliers of the

Mexican economy are 1.45 and 1.98. It is important to highlight that, compared to the economy's major divisions; NAB industry has the second highest income multiplier and the highest output multiplier (Table 9). This could possibly be the consequence of the high productivity and salaries in the industry, as was discussed in Chapter 2.

The industry being analyzed has an employment multiplier similar to the average in the country (2.94 compared to 3); however, the agriculture sector is the major generator of employment (10.63), followed by the construction sector (3.30) and the NAB industry (2.94). Given its total contribution to gross output, the services sector is ranked top (54.88%), followed by the manufacturing sector (43.48%). The contribution of the NAB industry is 1.07%.

Another measure of the NAB industry multiplier effect on Mexican economy is the known "impact multiplier". It is computed dividing the total contribution by the direct contribution of NAB industry to the gross output.

It is important to highlight that the impact multiplier of the NAB industry is higher than that of the manufacturing industry, the food, beverage and tobacco industry, and the beverage industry. This means that the NAB industry has greater multiplier than the average of the processing industry and the producing sectors of the group in which it is classified.

Table 9. Output, Income and Employment Multipliers, and Total, Direct and Indirect Contribution by Economic Division, 2012*

Economic division	Multipliers			Contribution		Multiplier	
	Output	Income	Employ	Total	Direct	Indirect	Impact**
11 Agriculture, Forestry, Fishing and Hunting	1.45	1.88	10.63	3.79%	2.90%	0.89%	1.31
21 Mining	1.19	1.40	0.43	6.99%	6.01%	0.98%	1.16
22 Utilities	1.58	2.05	1.17	3.38%	1.76%	1.62%	1.92
23 Construction	1.50	2.33	3.30	12.07%	8.69%	3.38%	1.39
31-33 Manufacturing	1.53	1.87	1.60	43.48%	33.69%	9.79%	1.29
Food, Beverages and Tobacco	1.77	2.15	3.41	11.50%	7.45%	4.06%	1.54
Beverages	1.70	2.15	2.51	1.77%	1.03%	0.74%	1.72
Non-Alcoholic Beverages	1.76	2.28	2.94	1.07%	0.61%	0.46%	1.75
43-46 Trade	1.27	1.78	2.59	26.00%	11.79%	14.20%	2.20
48-93 Services	1.32	2.27	2.28	54.88%	34.54%	20.33%	1.59
Average	**1.45*** **	**1.98**	**3.00**	NA	NA	NA	NA

Source: created by the authors.

* The sum of the partial amounts does not coincide with the total given that they are rounded up.

** Result of dividing the total contribution by the direct contribution.

NA= Not applicable.

*** The average product multiplier for the Mexican economy is slightly lower than that stipulated in the chapter dealing with Rasmussen's classification (1.47) given that it was calculated at a lower level of disaggregation.

4. The effect of the tax on soft drinks

In 2014, a tax reform, which included a special tax of $1 per liter on sugary drinks, was introduced. Given the importance of soft drinks within the beverage industry, this tax could, in practical terms, be seen as a tax on sugary soft drinks. One of the arguments for taxing sugary soft drinks is that this is a public health measure. That is, the tax on soft drinks, rather than just being a means of increasing revenue, is a measure which aims to reduce obesity.

Fletcher, Frisvold and Tefft (2010) explain that state governments in the United States (USA) have used taxes that specifically target soft drinks to generate income since the 1920's; however, in recent years, a number of state governments have presented plans to tax soft drinks in order to reduce obesity, especially among children and young people. The argument seems to mainly focus on the fact that taxes on soft drinks discourage consumption and, as a result, reduce obesity among children and young people.

A key element in the discussion regarding the effectiveness of the tax on soft drinks, being a measure to generate tax revenue or to combat obesity, is the price elasticity of demand. In many markets, specific taxes are passed on to consumers as price increases; this phenomenon tends to generate a reduction in the consumption of the taxed good. The more elastic the demand, the greater the reduction in consumption as a result of the tax; however, this also means that revenue is lower. Therefore, the effectiveness of a tax to reduce obesity is in juxtaposition to its ability to generate revenue.

This chapter contains two types of complementary analysis regarding the special tax on sugary drinks. Firstly, a number of econometric exercises, focusing on a partial equilibrium model, will be shown, helping to provide an estimate of the price elasticity of the demand for soft drinks and the effect of the tax. Secondly, several general equilibrium exercises are presented to help establish the impact the tax has on other sectors of the economy.

4.1. Partial equilibrium analysis

According to data from INEGI, the average price of soft drinks (before taxes) was approximately $7 per liter at the end of 2013. Using this figure as a starting point, adding VAT would lead to a price of $8.12 per liter of soft drink after tax. As a result, if the new tax is passed down to consumers in its entirety, then the price of soft drinks would increase from $8.12 to $9.12 per liter. Therefore, in a competitive soft drink market, the tax would lead to an increase in the price of 12.3%. The corresponding data about soft drinks from the National Consumer Price Index (INPC) enables us to corroborate that the prices of soft drinks experienced an increase of this magnitude just as the tax came into effect.

As a result of the tax being transferred to consumers by means of a price increase, one would expect that the result of this increase in price would be a decrease in the sales of soft drinks. The magnitude of this decrease would depend on the sensitivity of the demand for soft drinks to changes in their price. This means that the effect of the tax on the sales of soft drinks (with everything else remaining constant) depends on the price elasticity of the demand.

It is not an easy task to establish the effect of the tax on sales (measured in liters) of soft drinks given that the sales of this good (unlike the price) vary constantly over time, and this makes it difficult to distinguish the effect that the policy in question had from the other factors that affect the sales of soft drinks. As such, it is important to carry out econometric exercises that help to separate the cyclical-seasonal effect of the sales of soft drinks or other economic factors resulting from the specific effect of the tax (be it directly or through the price).

There are a number of studies which have recently been published in economic journals that estimate the price elasticity of the demand for soft drinks in Mexico. For instance, Valero (2006) estimates that soft drinks have a price elasticity of 1.4 and, as such, are deemed to be an elastic good. In contrast, Fuentes and Zamudio (2014) find that this elasticity is very sensitive to the way in which soft drinks are aggregated or disaggregated based on packaging sizes. The authors find that elasticity is greater than unity when soft drinks are considered to be a homogenous good. However, if elasticities are estimated separately for different packaging sizes, then estimates are between 0.16 and 0.44.

Unlike the previous studies, such as Valero (2006) or Fuentes and Zamudio (2014) that use cross-section household data (i.e., they use data from the ENIGH), this work estimates the demands for soft drinks and bottled water in the country with information from industry sales time series.[12] This approach has a number of advantages. Firstly, the variation in the real prices of beverages corresponds to the changes that happen over time and not as a result of the differences between the prices found in different regions within the country or for different packaging sizes. Secondly, the time series includes the precise moment when the price of soft drinks was altered by the tax. The ENIGH is conducted every two years, during the second half of the corresponding year. As such, these surveys do not provide a snapshot of the moment when the tax came into effect. Thirdly, the data from these household surveys provides detailed information about consumption at home, but not so with regards to consumption away from home.

4.1.1. Data

The data used in these estimations come from the Bank of Economic Information of INEGI, covering the period encompassing January 2007 to August 2014. This information is found on the INEGI's website and is available to the public. The sales volume of soft drinks or bottled water in Mexico comes from the Monthly Survey of the Manufacturing Industry (EMIM). This variable, measured in liters, is divided by a monthly projection of the country's population based on population growth rates published by the INEGI's Population and Household Censuses. The variable (Q) is the average number of liters of soft drinks or water sold daily per person. The prices of soft drinks or bottled water are based on the National Consumer Price Index in its Classification of Individual Consumption by Purpose (INPC-CCIF). The corresponding sub-index is divided by the general index in order to obtain the real price index for soft drinks or water (P). The Global Economic Activity Indicator (IGAE) is found in the recent economic indicators published in the BIE and is used as a proxy income variable (Y).

[12] The demands for soft drinks and water are estimated separately for the purpose of comparison. The tax is expected to have no relevant effects on the sales of water.

4.1.2. Econometric exercises

Two econometric exercises were carried out. The first exercise follows Fuentes and Zamudio (2014) estimating the double logarithmic demand:

$$\ln(Q) = \alpha + \beta \cdot \ln(P) + \gamma \cdot \ln(Y) + \varepsilon \, .$$

This type of function is simple and fairly standard in the empirical economics literature. One of its advantages is that it allows a direct estimation of the price elasticity (i.e., the absolute value of β) of the good.

Given that we are working with time series instead of cross-section data, it is important to add some variables in order to control the trends and seasonality that can affect the sales of water or soft drinks in the country. As such, we have used the variable *T*, which takes the values 1, 2, 3,…, 92 as the months of the period of the study elapse. This variable captures the tendency of the series. Furthermore, dichotomous variables were used, corresponding to each one of the months of the year. As such, the seasonality of the series is controlled. The month of December serves as a point of reference and, as such, is omitted in the regression.

The second econometric exercise consists of substituting the price variable with a dichotomous variable that takes a value of 0 in the months prior to the tax coming into effect and a value of 1 in the subsequent months after its enforcement. Given the fact that the effect of the tax is reflected in the price, it was deemed necessary to omit the price variable in this regression. The rest of the variables remained unchanged.

4.1.3. Results

The parameters of interest in these two exercises are the price elasticity and the effect of the tax, respectively. Nevertheless, the results of the regressions are shown in Table 10. According to the results of the first exercise, the price elasticity of demand is 0.25. Given that the price of soft drinks increased by 12% after the tax came into effect, it is therefore estimated that the sales of soft drinks in the country dropped by 3% as a result of the tax. On

the other hand, the second econometric exercise allows us to estimate that the sales of soft drinks decreased by 4.3% as a result of the tax. The implicit price elasticity in this case is a little higher (0.36). Nevertheless, these figures are within the range of the estimations made by Fuentes and Zamudio (2014).

Table 10. Regressions of the Sales of Soft Drinks and Water

	Soft Drinks		Water	
Variable	Exercise 1	Exercise 2	Exercise 1	Exercise 2
CONSTANT	-2.176***	-2.372***	-2.685***	-2.678***
LN P	-0.249*	(NA)	-0.319	(NA)
LN Y	0.277*	0.319**	0.102	0.098
T	0.000	0.000	0.001**	0.001***
TAX	(NA)	-0.043***	(NA)	-0.006
JANUARY	-0.106***	-0.102***	0.037*	0.038*
FEBRUAR	-0.041*	-0.038*	0.109***	0.110***
Y MARCH	0.002	0.004	0.186***	0.188***
APRIL	0.082***	0.084***	0.277***	0.276***
MAY	0.097***	0.096***	0.295***	0.291***
JUNE	0.110***	0.109***	0.314***	0.310***
JULY	0.076***	0.074***	0.216***	0.213***
AUGUST	0.080***	0.079***	0.262***	0.259***
SEPTEMBER	0.017	0.016	0.203***	0.199***
OCTOBER	-0.012	-0.015	0.165***	0.162***
NOVEMBER	-0.022	-0.024	0.083***	0.083***
Adjusted R^2	0.746	0.759	0.876	0.876

NB: The symbols *, ** and *** indicate that the corresponding coefficient is significant: 10, 5 and 1%, respectively.

In order to better understand the effect of the tax on the sales of soft drinks, the following calculations can be made. In 2013, 18.395 billion liters of soft drinks were sold. The sales projection, taking into consideration the lowest price elasticity model (i.e., a conservative approach), allows us to estimate that, in 2014, sales would have been 566.9 million liters greater without the tax. The value of this production of soft drinks is $4.603 billion pesos including $634.92 million pesos of VAT.

4.2. Effects of the IEPS on soft drinks in a multisectoral context

In this section, we estimate the effects of the tax on sugary beverages with a focus on a general equilibrium model. In order to achieve this, we use the input-output method. Two models are created with different objectives. On the one hand, we use a price model to measure the impact of the tax on the prices of all goods and services and the costs of household consumption. On the other hand, we use Leontief's Open Model to estimate the effects of the tax on output, income and employment.

4.2.1. Effect on prices and private consumption

The input-output price model is based on the IOT given that this matrix helps to estimate the cost structure of the economic sectors in question. This model also allows us to analyze the impact of a policy that affects the unit cost of production of a specific activity and, consequently, the effect on the prices of this and other economic activities stemming from the commercial relationships that exist between them. The model can be used to analyze tax, tariff and wage indexation policies, as well as the effects of changes in the price of imported goods.[13]

It is important to mention that the price of the sector in question can be assumed exogenous in the model. Hence, it is possible to measure and track the effects of this exogenous price change throughout the economic system. This is the strategy we will be following in this section. The change in the prices of soft drinks as a result of the increase in the IEPS is introduced as an exogenous change in the price of the NAB sector. As we explained in previous chapters, the price of soft drinks increased by 12% when the tax on sugary beverages came into effect.

The model includes 261 economic sectors, 2 primary factors (labor and capital), an

[13] For information about the price model, please consult Pulido and Fontela (1993) and Blair and Miller (2013). This model is also applied to the Mexican economy in the following studies: Chapa (2003), Arteaga, Chapa and Ramírez (2009), Ayala and Chapa (2011), Arteaga and Chapa (2011).

external sector, a government and a representative household.[14] The NAB sector will be considered exogenous in the model, while the remaining 260 sectors will be considered endogenous.[15]

The model is calibrated using the 2012 Mexico's Domestic Input-Output Table based on economic activity (2012 National IOT); however, some modifications were made given the fact that NAB are the main focus of this study and the important role sugar plays as an input for this industry. This is why the beverages sector (3121) is divided into NAB and alcoholic beverages, while the sugar, chocolates, confectionery and similar products (3113) sector is divided into two parts: sugar and chocolates, and confectionary and similar products.[16]

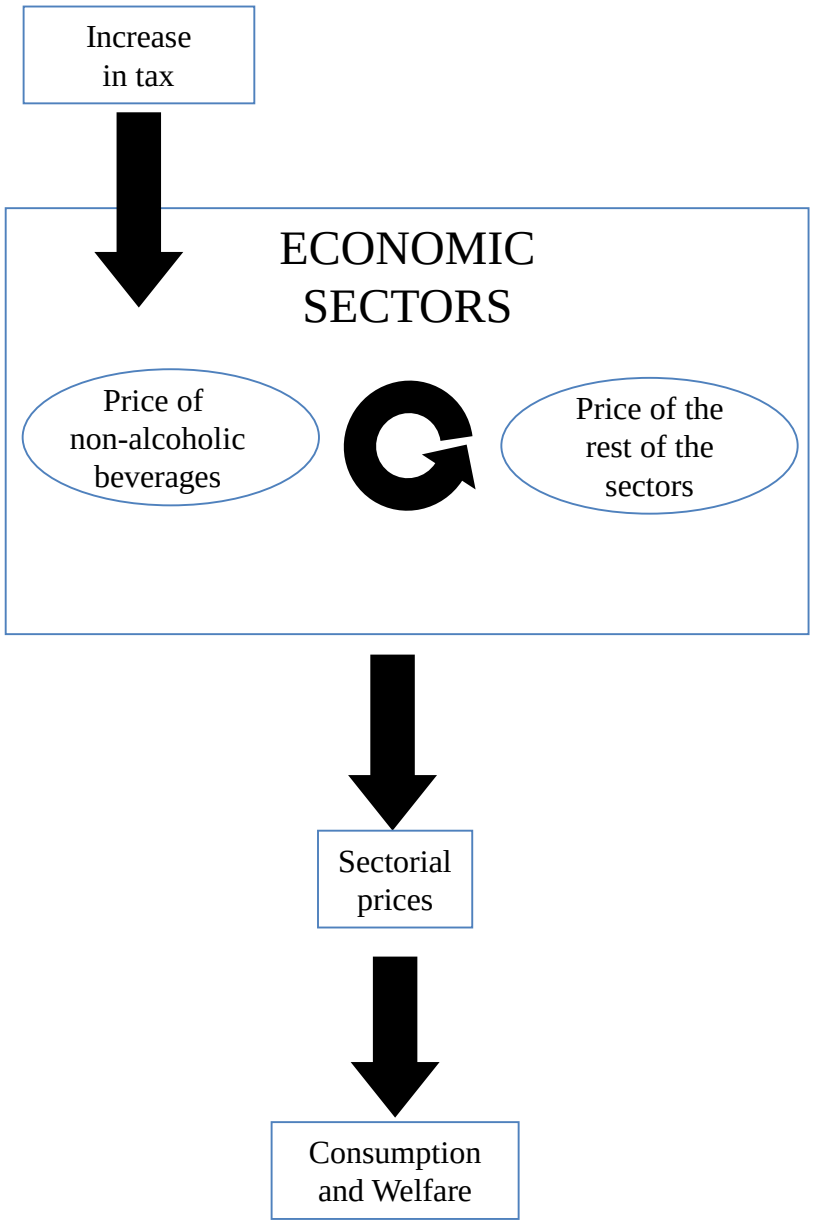
Two simulations were made using this model. In the first, the nominal wage is exogenous. Therefore, the model captures the following sequence of effects: (a) an initial price increase in the NAB sector leads to an increase in the unit cost of production and, as a result, an increase in the prices of the economic sectors it supplies (for example, restaurants); (b) this increase in the prices of these economic sectors, such as restaurants, leads to an increase in the unit cost of production and, as a result, an increase in the prices of economic sectors that purchase services from restaurants (for example, the freight trucking sector); and so on. It follows that the prices of final goods increase. While this happens, the cost of the bundle of goods that the representative household in the country consumes increases too. This leads to a reduction in households' well-being because they no longer enjoy the consumption level they once had (see Figure 1).

[14] The technical details of the model are found in Appendix A.4.1.

[15] The economic activity that we have called "non-alcoholic beverages" includes the following NAICS classifications: Manufacturing of soft drinks and other non-alcoholic beverages (312111), Purification and bottling of water (312112) and the Manufacturing of ice (312113).

[16] The following areas of economic activity were divided using the 2008 Domestic Input-Output Table at class level: sugar, chocolates, confectionery and similar products (3113) and beverages (3121).

Figure 1. The effects of a tax increase with an exogenous wage



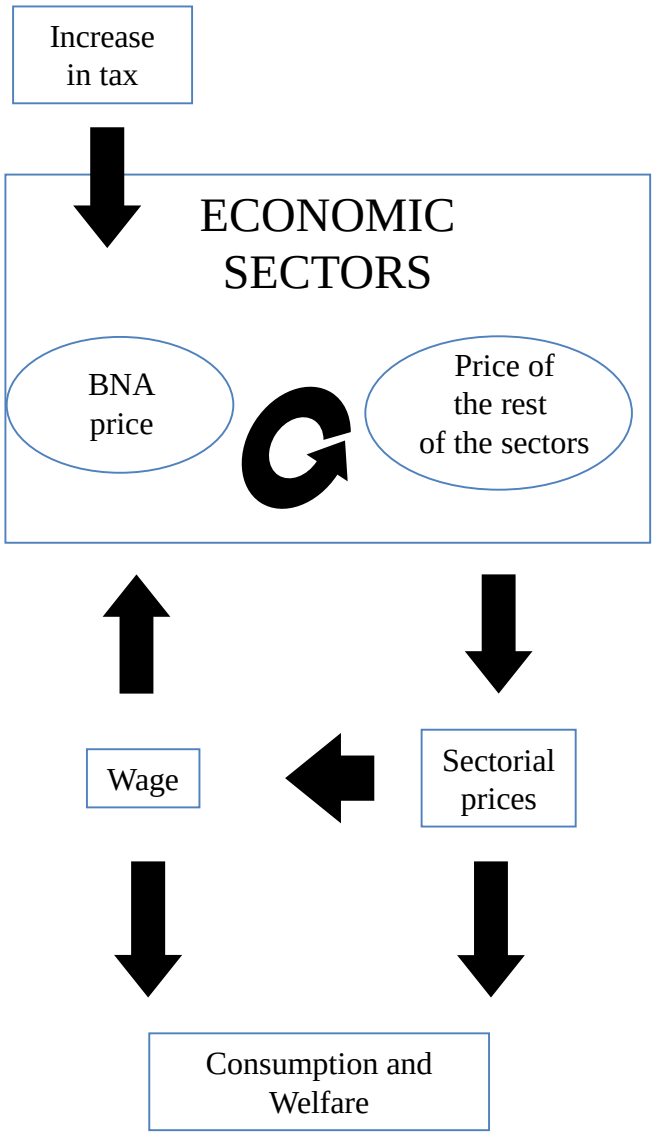
Source: made by the authors.

In the second simulation, the assumption that nominal wages are fixed is relaxed. Instead, it considers that real wages are constant. That is, it assumes that wages are indexed to the CPI. Hence, the model captures the following sequence of events: (a) an initial increase in the price of the NAB sector leads to an increase in the unit cost of production and, as a result, an increase in the prices of the economic sectors it supplies (for example restaurants); (b) increased prices in these sectors, such as restaurants, lead to an increase in the unit cost of

production and, as a result, an increase in the prices of economic sectors that purchase services from them (for example, the freight trucking sector); and so on. As the prices of final goods increase, so does the cost of the bundle of goods consumed by the representative household in the country (CPI) and so do wages, leading to an additional increase in the prices of all economic sectors.

The second simulation highlights two effects of the tax on the demand for consumer goods: a negative effect as a result of the increase in prices and a positive effect as a result of the increase in income from nominal wages. Therefore, the demand for goods provided by the economic sectors that are productively linked to the NAB sector decreases. In these cases, the effect of the increases in prices dominates the effect of the increase in wages. In contrast, the demand for goods provided by the sectors that are not productively linked to the NAB sector increases. In these cases, the effect of the increase in wages dominates the effect of the increase in prices. However, the effect of the increase in prices dominates in the economy as a whole. Therefore, the cost of the bundle of goods consumed by the representative household in Mexico increases while its well-being decreases (see Figure 2).

Figure 2. Tax increment effects (Endogenous Wage)



Source: made by the authors.

Calibrating the initial impact on prices

As we mentioned previously, the increase in the tax on sugary beverages led to a 12% increase in the price of soft drinks; however, the model considers all the NAB sector, so the increase in the price of soft drinks was calculated based on the contribution of soft drinks to the NAB sector which, according to the Economic Census of 2008, is 90%. Hence, the 12% increase in the price of soft drinks is the equivalent to an increase of 10.75% in the price of

the NAB sector, which we will incorporate into the model.

Key assumptions of the model

It is important to state that this model assumes that the change in the price of NAB is transferred instantaneously to the costs and prices of the economic sectors that purchase from it. Similarly, it is assumed that the price elasticities of demand are equal to one. The latter is not necessarily true for the NAB industry. As was explained earlier, there is mixed evidence regarding the value of this elasticity; however, the main virtues of this exercise is that it offers an approximate idea of the effects of the tax throughout the economy and that it allows identifying the economic sectors which, directly or indirectly, are most affected by the tax.

First simulation: exogenous wage

The 10.75% increase in the price of NAB led to a 0.18% increase in the CPI or the cost of the bundle of goods consumed by the representative Mexican household. In addition to the NAB sector, the economic sectors that were most affected by the tax are those that purchase inputs from NAB sector. Among them, those that saw increases in price of at least 0.1% are: Fishing; Full-service restaurants; Services relating to non-depository credit intermediation; Rental and leasing services; Drinking Places (Alcoholic Beverages); Credit unions and savings institutions; and, Caterers (see Table 11).

Table 11. Effect of the tax increase assuming exogenous wages*

NAICS Code	Description	Effect (%)
31211	Non-alcoholic beverages	10.75
1141	Fishing	0.40
7221	Full-service restaurants	0.34
5225	Services relating to non-depository credit intermediation	0.24
5323	Rental and leasing services	0.23
7224	Drinking Places (Alcoholic Beverages)	0.13
5223	Credit unions and savings institutions	0.13
7223	Caterers	0.10
	CPI	0.18

Source: created by the authors.
NB: * Due to space constraints, only those sectors with the most significant effects are presented.

Given that nominal income remains constant, the generalized increase in prices leads to a 0.16% decrease in consumption of the representative household in Mexico. In terms of money, this means that consumption decreased by $14,977.66 million pesos. This figure represents 0.1% of the GDP (see Table 12).

By economic sector, the sector most affected by the tax is naturally the NAB industry. Sales in this sector dropped $14,399.43 million pesos. This number represents 23.81% of the GDP of the sector. The effect of the tax on sales in the sector is considerable; however, it is important to state that this is the result of assuming the corresponding price elasticity of demand is one.

In addition to the NAB sector, the other sectors whose sales were most affected in absolute terms are: Full-service restaurants; Wholesale grocery and food; Commercial banking; Self-service restaurants, takeaway food and other limited-service restaurants, among others. For example, the decrease in sales of full-service restaurants reaches $163.41 million pesos. This figure represents 0.42% of GDP of this sector.

Table 12. Effect of the tax on consumption assuming exogenous wages*

NAICS Code	Description	Effect	
		Million pesos	% of Sectoral GDP
31211	Non-alcoholic beverages	-14,399.43	-23.81
7221	Full-service restaurants	-163.41	-0.42
4311	Wholesale grocery and food	-69.05	0.00
5221	Commercial banking	-61.64	-0.03
7222	Self-service restaurants, takeaway food and other limited-service restaurants	-56.77	-0.07
1141	Fishing	-39.90	-0.63
7223	Caterers	-35.09	-0.10
5223	Credit unions and savings institutions	-28.46	-0.21
5224	Services relating to non-depository credit intermediation	-23.65	-0.04
7224	Drinking Places (Alcoholic Beverages)	-20.84	-0.20
	Total	-14,977.66	-0.10

Source: created by the authors.
NB: * Due to space constraints, only those sectors with the most significant effects are included.

Second simulation: endogenous wage

The effect of the tax on prices is greater when the nominal wage is indexed to the CPI. In this case, the cost of the bundle of goods consumed by the representative household in the country increases by 0.21% as a result of the increase in price of the NAB stemming from the IEPS (see Table 13). The economic sectors that see the greatest increase in their production costs, and therefore the price they charge, are those that purchase inputs from the NAB sector or those that make intensive use of labor and, as such, those for which wages play a major role in their cost structures. The sectors that exhibit an increase in price above 0.19% are: NAB, Fishing, Full-service restaurants, Services relating to non-depository credit intermediation, Rental and leasing services, Households with domestic employees, Credit unions and savings institutions, and Drinking Places (Alcoholic Beverages).

Table 13. Effects of the tax on sectoral prices assuming endogenous wages*

NAICS Code	Description	Effect (%)
31211	Non-alcoholic beverages	10.75
1141	Fishing	0.43
7221	Full-service restaurants	0.41
5225	Services relating to non-depository credit intermediation	0.29
5323	Rental and leasing services	0.25
8141	Households with domestic employees	0.20
5223	Credit unions and savings institutions	0.20
7224	Drinking Places (Alcoholic Beverages)	0.19
	W=CPI	0.21

Source: created by the authors.
NB: * For reasons of space, only those sectors with the most significant effects are presented. .

Even though the effect on the CPI is greater in the model with indexed salaries compared to the model with fixed salaries, the negative effect on aggregate consumption is lower. This is due to the assumption that labor income in real terms remains constant. As such, consumption in households decreases slightly less. In this case, the decrease in consumption is $13,045.75 million pesos. This figure represents 0.09% of GDP (see Table 14).

In this simulation, sales in the NAB sector decrease by $14,325.60 million pesos. This represents 23.69% of the GDP of the sector and is very similar to that found in the previous simulation. Furthermore, as was explained in the previous exercise, the economic sectors in which the negative effect of the increase in prices is most relevant are those which most use NAB and/or labor as inputs. These include the following: Full-service restaurants, Households with domestic employees, Elementary and Secondary Schools, Colleges, Universities, and Professional Schools, Commercial banking, Self-service restaurants, takeaway food and other limited-service restaurants, General hospitals, Fishing and Caterers. The sales of final goods in these sectors fall between $35 and $170 million pesos.

In contrast, the economic sectors in which the effect of the increase in labor income is most felt are those in which prices increase at a low rate given that these sectors are not productively linked to the NAB sector and/or wages play a minor role in their cost structures. The ten economic sectors that saw the greatest increase in their sales experience increases that vary between $42 and $794 million pesos (see Table 14).

Table 14. Effect of the tax increase on consumption assuming an endogenous wage*

NAICS Code	Description	Effect	
		Million pesos	% of Sectoral GDP
31211	Non-alcoholic beverages	-14325.60	-23.69
7221	Full-service restaurants	-170.47	-0.44
8141	Households with domestic employees	-104.71	-0.15
6111	Elementary and Secondary Schools	-99.62	-0.02
6113	Colleges, Universities, and Professional	-62.46	-0.04
5221	Commercial banking	-57.45	-0.02
7222	Self-service restaurants, takeaway food and other limited-service restaurants	-47.32	-0.06
6221	General hospitals	-38.33	-0.03
1141	Fishing	-37.74	-0.59
7223	Caterers	-35.98	-0.10
7211	Traveler Accommodation	42.77	0.03
3363	Motor Vehicle Parts Manufacturing	43.60	0.03
3361	Motor Vehicle Body and Trailer	59.94	0.03
5172	Wireless telecommunications carriers (except satellite)	60.75	0.05
4852	Interurban and rural bus transportation	70.18	0.06
3116	Animal slaughtering and processing	71.80	0.06
3241	Petroleum and Coal Products Manufacturing	93.76	0.08
3118	Bakeries and Tortilla Manufacturing	103.03	0.05
4311	Wholesale grocery and food	186.07	0.01
5311	Lessors of Real Estate	794.10	0.05
Total		**-13,045.75**	**-0.09**

Source: created by the authors.

NB: * Due to space constraints, only those sectors with the most significant effects are presented here.

4.2.2. Effects on output, income and employment

In this section, input-output multipliers are used to quantify the effects of the decrease in private consumption caused by the increase in the price of NAB on output, income and employment by economic sector.

The input-output multipliers are calculated based on Leontief's Open Model. More information on this model can be found in Appendix A.4.2. Unlike the price model, which identifies the sectors which are affected given their dependency on the goods sold by the NAB industry, the quantities model offers an insight into the impact on the economic sectors that provide the NAB sector with inputs.

Calibrating the initial impact on private consumption

We will carry out two simulations. In the first simulation, the starting point will be the drop in sales obtained from the partial equilibrium model with some adjustments. On the one hand, Value Added Tax is removed. On the other hand, the drop in sales is brought in line with 2012 prices in order to tie in with the units of measurement in the model. The result is a reduction of $3,674.4 million pesos (see Table 15). It is important to highlight the fact that this calculation assumes a price elasticity of demand of 0.25. In the second simulation, the starting point is the drop in sales of the NAB sector that is dictated by the price model that takes wages as being exogenous, which reaches $14,399.43 million pesos. In this case, it is assumed that the price elasticity of demand of the NAB is 1.

Table 15. Soft drinks sales reduction from the partial equilibrium model

Concept	Value
Initial estimation (millions of pesos in 2014)	4,603.2
VAT (millions of pesos in 2014)	634.9
Initial estimation minus VAT (millions of pesos in 2014)	3,968.3
CPI 2014 (base period 2012)	108.0
Reduction on soft drinks sales (millions of pesos in 2012)	3,674.4

Source: created by the authors.

Results

The $3,674.4 million peso reduction in sales of NAB led to a reduction in the total output of the Mexican economy of $6,454 million pesos, which represents 0.04% of GDP (see Table 16). By economic sector, the most affected ones are those which supply inputs to the NAB industry, including: Other food industries; Wholesale grocery and food; Manufacturing of plastic products; Sugar; Preserving of fruits, vegetables and specialty food; Other crops; Petroleum and Coal Products Manufacturing; Water collection, treatment and supply; and, Employment services. Note that these include sugar, plastic products for bottling and water.

In terms of employment, the results suggest a loss of 10,815 jobs. Around 67% of this loss is concentrated in the NAB industry and the other crops sector.

The effect on labor income reaches $686 million pesos. The most affected sectors in terms of income are: Employment services; Wholesale grocery and food; Other crops; Sugar; and, Water collection, treatment and supply.

The results seen in the second simulation are greater, given that the price elasticity is unitary, but qualitatively they are the same, i.e. the most affected sectors are the same as in the first simulation (see Table 17). In a scenario in which the sales of NAB fall by $14,399.43 million pesos, production, employment and income decrease by $25,292 million pesos, $42,382 jobs and $2,689 million pesos, respectively.

Table 16. Effects on output, income and employment of a reduction in the consumption of NAB, Simulation 1*

Effect on Output			**Effect on Employment**			**Effect on Income**		
Code	**Description**	**Effect**	**Code**	**Description**	**Effect**	**Code**	**Description**	**Effect**
31211	Non-alcoholic beverages	-3685	31211	Non-alcoholic beverages	-4186	31211	Non-alcoholic beverages	-345
3119	Other food industries	-340	1119	Other crops	-3103	5613	Employment services	-65
4311	Wholesale grocery and food	-336	4311	Wholesale grocery and food	-736	4311	Wholesale grocery and food	-44
3261	Manufacturing of plastic products	-251	5613	Employment services	-629	1119	Other crops	-34
31131	Sugar	-246	2221	Water collection, treatment and supply	-233	31131	Sugar	-32
3114	Preserving of fruits, vegetables and specialty food	-140	3261	Manufacturing of plastic products	-224	2221	Water collection, treatment and supply	-24
1119	Other crops	-137	3119	Other food industries	-220	3261	Manufacturing of plastic products	-19
3241	Petroleum and Coal Products Manufacturing	-128	1113	Fruit and Tree Nut Farming	-191	3119	Other food industries	-14
2221	Water collection, treatment and supply	-126	31131	Sugar	-162	4841	General Freight Trucking general	-10
5613	Employment services	-102	1111	Oilseed and Grain Farming	-125	5611	Office Administrative Services	-9
	Total	**-6,454**		**Total**	**-10,815**	**Total**		**-686**

Source: created by the authors.

NB: * For reasons of space, only those sectors with the most significant effects are presented. .

Table 17. Effects on output, income and employment of the consumption reduction of non-alcoholic beverages, Simulation 2*

Effect on Product			**Effect on Employment**			**Effect on Income**		
Code	**Description**	**Effect**	**Code**	**Description**	**Effect**	**Code**	**Description**	**Effect**
31211	Non-alcoholic beverages	-14,442	31211	Non-alcoholic beverages	-16,406	31211	Non-alcoholic beverages	-1,351
3119	Other food industries	-1,332	1119	Other crops	-12,162	5613	Employment services	-255
4311	Wholesale grocery and food	-1,316	4311	Wholesale grocery and food	-2,886	4311	Wholesale grocery and food	-173
3261	Manufacturing of plastic products	-986	5613	Employment services	-2,463	1119	Other crops	-133
31131	Sugar	-962	2221	Water collection, treatment and supply	-911	31131	Sugar	-127
3114	Preserving of fruits, vegetables and specialty food	-549	3261	Manufacturing of plastic products	-878	2221	Water collection, treatment and supply	-93
1119	Other crops	-539	3119	Other food industries	-860	3261	Manufacturing of plastic products	-73
3241	Petroleum and Coal Products Manufacturing	-501	1113	Fruit and Tree Nut Farming	-750	3119	Other food industries	-56
2221	Water collection, treatment and supply	-494		Sugar	-633	4841	General Freight Trucking general	-39
5613	Employment services	-400	1111	Oilseed and Grain Farming	-489	5611	Office Administrative Services	-33
	Total	**-25,292**		**Total**	**-42,382**	**Total**		**-2,689**

Source: created by the authors.

NB: * Due to space constraints, only those sectors with the most significant effects are presented here.

Conclusions

The Non-Alcoholic Beverage Industry (NAB) plays a major role in Mexico. On the one hand, households earmark a substantial portion (2.7%) of their budget to purchase NAB. On the other hand, this industry is linked to other sectors of the economy in the country. Moreover, the industry is a major purchaser of intermediate inputs in the Mexican economy. Furthermore, this industry has above-average spillover effects on product, income and employment compared to the Mexican economy in general and, in particular, the manufacturing industry.

NAB and soft drinks are normal and necessary goods in an economic sense. This means that households tend to consume more NAB and soft drinks as their income level increases; however, the percentage of NAB and soft drinks in terms of total spending tends to fall as household income level increases. This is important as it helps to clarify some doubts regarding the impact of a tax on these products. Even though the highest levels of tax revenue come from the richest households (those who consume more of these goods in absolute terms), the tax burden hits the poorest households hardest (those who consume more in relative terms). As such, it is deemed that the taxes on NAB and soft drinks are regressive.

Over the last number of years, beverages have remained at a stable price. To be more precise, except for the time when prices increased as a result of the tax on sugary beverages (at the beginning of 2014), the prices of NAB have simply adjusted to reflect the effects of inflation. The price of bottled water has increased slightly below inflation.

The most significant products in the NAB sector, given their importance in household consumption and given their production volume, are soft drinks and bottled water. Although soft drinks have a major advantage in terms of consumer preference (they represent 63% of household spending on NAB), we can see that bottled water is gradually gaining ground on soft drinks. In a certain way, this change reflects a growing interest among consumers for healthy and low-calorie beverages; however, this comment should be taken with caution.

Although their growth rate over the past number of years (2007-2014) has been relatively low (1.9%), the production (and sales) of soft drinks is much higher than that of bottled water and, as such, will take many years, if it actually happens, for the gap to close significantly. Furthermore, the soft drink industry adapts to the needs and preferences of consumers by offering a greater variety of low-sugar beverages in order to compete with bottled water. It is important to mention that the production of these beverages over the past number of years has grown at even greater rates (6.3%) than the production of bottled water (4.3%).

Reviewing the consumption of NAB and, particularly, soft drinks from the 1990's to the current day allows us to establish that the consumption of NAB tends to increase while the consumption of soft drinks remains stable; however, there are certain differences in the consumption of soft drinks among households based on their income. The poorest households tend to consume more NAB in general (including soft drinks). Households with medium income tend to consume more NAB and have not significantly modified their consumption of soft drinks. The richest households tend to consume more NAB but have substituted soft drinks with other beverages. This reduction in the consumption of soft drinks among the richest households came at the end of the 1990's and the beginning of this century; however, over the past 10 years, the consumption of soft drinks among the richest households has remained stable.

It is notable that the consumption of soft drinks and water does not change significantly as a result of economic cycles or changes in price. The demand for soft drinks has relatively low price and income elasticities (0.25 and 0.28, respectively), while the demand for water is unaffected by these variables. In contrast, the demand for soft drinks and the demand for water demonstrate a clear seasonal-climate cyclical behavior. The consumption of these products increases in summer and drops in winter. It is conspicuous that the consumption of soft drinks hits its lowest point in the seasonal cycle in the month of January. Daily sales of soft drinks per person in this month are systematically lower than during any other month of the year. One possible explanation for this phenomenon is New Year's resolutions.

The average consumption of soft drinks per person over the past number of years has fluctuated between 350 and 500 milliliters per day. These quantities of soft drinks, ignoring the fact that some are diet drinks, contribute between 5% and 7% of the calories corresponding to the average caloric intake among people in Mexico. Given that the average caloric intake of people in Mexico is 51.2% above international recommendations, it is difficult to maintain that soft drinks are the fundamental cause of obesity in the country.

The fact that the demand for soft drinks is inelastic and that it is perceived as unhealthy by individuals makes this product prone to being taxed. The tax is passed on to consumers as a price increase and this leads to a drop in sales. It is estimated that the special tax on high-calorie beverages reduced the sales of soft drinks by only 3%. This means that the average daily consumption of soft drinks per person dropped by 15 milliliters. It is therefore estimated that, in the best case scenario, the tax reduced the average kilocalorie intake of people in Mexico by 0.21%. In other words, more than reducing the consumption of soft drinks and combating obesity, the tax on soft drinks led to a significant increase in tax revenue.

The NAB industry provides direct employment to more than 100,000 people. The jobs within the soft drink industry are the best paid positions in the NAB industry. Furthermore, over the past number of years, average wages in the soft drink industry have been between 20% and 40% higher than those in the manufacturing industry. Although the NAB industry is part of the manufacturing industry, employment in the NAB industry does not behave like that in the manufacturing industry. For example, employment in this industry remained relatively stable during the crisis and did not grow significantly during the period of recovery after the event. In fact, employment in the NAB industry, and especially in the soft drink industry, has been gradually decreasing over the past number of years. This decrease is related to an increase in productivity.

The NAB industry is mainly a producer of final goods. It is estimated that almost 96% of the gross output is bought by consumers. The rest is sold as intermediate inputs to specific sectors, such as restaurants. Furthermore, the industry is a major purchaser of inputs. In the cost structure of this industry, half of the resources are earmarked for paying capital, labor and imports, while the other half is spent on intermediate inputs such as: plastic,

sugar, glass, water, fruit and other foods. It is important to emphasize the fact that these inputs are important for the NAB industry, but the NAB industry is also important for the producers of these inputs.

There are some aspects that companies from the NAB industry need to monitor. Firstly, production could be affected by difficulties in accessing certain essential inputs. Specifically, essential inputs can be defined as sugar and water. These two inputs are fundamentally important in the production process and are prone to changes in the weather. Secondly, the industry buys a major part of its inputs from abroad (13% of its cost structure) and sells its production in the domestic market. As such, the industry is exposed (at least moderately) to currency exchange variations.

Given the size of its multipliers (its output multiplier is 1.75 and its multiplier of a uniform expansion of demand is 1.21), the NAB industry is deemed to be a backward oriented sector. This means that it is an industry that generates significant activity in other sectors of the economy through the direct and indirect purchasing of intermediate inputs. It is important to highlight that the output multiplier of the NAB industry exceeds the multipliers of the Mexican economy (1.45) and the manufacturing industry (1.53).

The NAB industry also shows large income (2.28) and employment (2.94) multipliers. For example, these multipliers are substantially higher than those corresponding to the manufacturing industry (1.87 and 1.6, respectively). Furthermore, if the income multiplier of NAB is compared to those of the major divisions of economic activity, only the construction industry's multiplier exceeds the one of the NAB industry. The NAB industry's income multiplier is considerably large for three reasons: (a) it is a major source of demand for intermediate goods; (b) it pays relatively high salaries; and (c) it is an important provider of final goods.

The contribution of the NAB industry to the Mexican economy can be calculated by simulating the effects of the disappearance of the industry. The result of this exercise indicates that the NAB industry directly represents 0.61% of gross output and 0.46% indirectly. As such, it can be calculated that this industry contributes to almost 1.1% of gross output in the country.

The most conservative estimate of the impact that the tax on sugary beverages had on the economy leads us to the following effects. First, it is estimated that the sales of NAB dropped by 3,674 million pesos. Second, the value of total production in the economy of the country decreased by 6,454 million pesos (i.e., about 0.04% of GDP). Third, 10,815 jobs were lost (mainly in the NAB industry and the agriculture sector).

Appendix for Chapter 3

A.3.1 Description of economic activities included in the Input-Output Table

NO.	CÓDIGO CLASE SCIAN	
1	1111	Oilseed and Grain Farming
2	1112	Vegetable and Melon Farming
3	1113	Fruit and Tree Nut Farming
4	1114	Greenhouse, Nursery, and Floriculture Production
5	1119	Other crops
6	1121	Cattle Ranching and Farming
7	1122	Hog and Pig Farming
8	1123	Poultry and Egg Production
9	1124	Sheep and Goat Farming
10	1125	Aquaculture
11	1129	Other Animal Production
12	1131	Timber Tract Operations
13	1132	Forest Nurseries and Gathering of Forest Products
14	1133	Logging
15	1141	Fishing
16	1142	Hunting and Trapping
17	1151	Support Activities for Crop Production
18	1152	Support Activities for Animal Production
19	1153	Support Activities for Forestry
20	2111	Oil and Gas Extraction
21	2121	Coal Mining
22	2122	Metal Ore Mining
23	2123	Nonmetallic Mineral Mining and Quarrying
24	2131	Support Activities for Mining
25	2211	Electric Power Generation, Transmission and Distribution
26	2221	Water collection, treatment and supply
27	2222	Natural Gas Distribution
28	2361	Residential Building Construction
29	2362	Nonresidential Building Construction
30	2371	Utility Systems Construction
31	2372	Land Subdivision
32	2373	Highway, Street, and Bridge Construction
33	2379	Other Heavy and Civil Engineering Construction
34	2389	Other Specialty Trade Contractors
35	3111	Animal Food Manufacturing
36	3112	Grain and Oilseed Milling
37	31131	Sugar

38	31132-4	Chocolates, confectionery and similar products
39	3114	Preserving of fruits, vegetables and specialty food
40	3115	Dairy Product Manufacturing
41	3116	Animal slaughtering and processing
42	3117	Seafood Product Preparation and Packaging
43	3118	Bakeries and Tortilla Manufacturing
44	3119	Other food industries
45	31211	Non-alcoholic beverages
46	31212-4	Alcoholic Beverages
47	3122	Tobacco Manufacturing
48	3131	Fiber, Yarn, and Thread Mills
49	3132	Fabric Mills
50	3133	Textile and Fabric Finishing and Fabric Coating Mills
51	3141	Textile Furnishings Mills
52	3149	Other Textile Product Mills
53	3151	Apparel Knitting Mills
54	3152	Cut and Sew Apparel Manufacturing
55	3159	Apparel Accessories and Other Apparel Manufacturing
56	3161	Leather and Hide Tanning and Finishing
57	3162	Footwear Manufacturing
58	3169	Other Leather and Allied Product Manufacturing
59	3211	Sawmills and Wood Preservation
60	3212	Veneer, Plywood, and Engineered Wood Product Manufacturing
61	3219	Other Wood Product Manufacturing
62	3221	Pulp, Paper, and Paperboard Mills
63	3222	Converted Paper Product Manufacturing
64	3231	Printing and Related Support Activities
65	3241	Petroleum and Coal Products Manufacturing
66	3251	Basic Chemical Manufacturing
67	3252	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments s
68	3253	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing
69	3254	Pharmaceutical and Medicine Manufacturing
70	3255	Paint, Coating, and Adhesive Manufacturing
71	3256	Soap, Cleaning Compound, and Toilet Preparation Manufacturing
72	3259	Other Chemical Product and Preparation Manufacturing
73	3261	Plastics Product Manufacturing
74	3262	Rubber Product Manufacturing
75	3271	Clay Product and Refractory Manufacturing
76	3272	Glass and Glass Product Manufacturing
77	3273	Cement and Concrete Product Manufacturing
78	3274	Lime and Gypsum Product Manufacturing
79	3279	Other Nonmetallic Mineral Product Manufacturing

80	3311	Iron and Steel Mills and Ferroalloy Manufacturing
81	3312	Steel Product Manufacturing from Purchased Steel
82	3313	Alumina and Aluminum Production and Processing
83	3314	Nonferrous Metal (except Aluminum) Production and Processing
84	3315	Foundries
85	3321	Forging and Stamping
86	3322	Cutlery and Hand tools Manufacturing
87	3323	Architectural and Structural Metals Manufacturing
88	3324	Boiler, Tank, and Shipping Container Manufacturing
89	3325	Hardware Manufacturing
90	3326	Spring and Wire Product Manufacturing
91	3327	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing
92	3328	Coating, Engraving, Heat Treating, and Allied Activities
93	3329	Other Fabricated Metal Product Manufacturing
94	3331	Agriculture, Construction and Mining Machinery Manufacturing
95	3332	Machinery Manufacturing for the Manufacturing Industry Excluding Metalworking
96	3333	Machinery Manufacturing for the Service Sector
97	3334	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing
98	3335	Metalworking Machinery Manufacturing
99	3336	Engine, Turbine, and Power Transmission Equipment Manufacturing
100	3339	Other General Purpose Machinery Manufacturing
101	3341	Computer and Peripheral Equipment Manufacturing
102	3342	Communications Equipment Manufacturing
103	3343	Audio and Video Equipment Manufacturing
104	3344	Semiconductor and Other Electronic Component Manufacturing
105	3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing
106	3346	Manufacturing and Reproducing Magnetic and Optical Media
107	3351	Electric Lighting Equipment Manufacturing
108	3352	Household Appliance Manufacturing
109	3353	Electrical Equipment Manufacturing
110	3359	Other Electrical Equipment and Component Manufacturing
111	3361	Motor Vehicle Manufacturing
112	3362	Motor Vehicle Body and Trailer Manufacturing
113	3363	Motor Vehicle Parts Manufacturing
114	3364	Aerospace Product and Parts Manufacturing
115	3365	Railroad Rolling Stock Manufacturing
116	3366	Ship and Boat Building
117	3369	Other Transportation Equipment Manufacturing
118	3371	Household and Institutional Furniture and Kitchen Cabinet

		Manufacturing
119	3372	Office Furniture (including Fixtures) Manufacturing
120	3379	Other Furniture Related Product Manufacturing
121	3391	Medical Equipment and Supplies Manufacturing
122	3399	Other Miscellaneous Manufacturing
123	4311	Wholesale food and grocery
124	4811	Scheduled Air Transportation
125	4812	Nonscheduled Air Transportation
126	4821	Rail Transportation
127	4831	Deep Sea, Coastal, and Great Lakes Water Transportation
128	4832	Inland Water Transportation
129	4841	General Freight Trucking
130	4851	Urban Transit Systems
131	4852	Interurban and Rural Bus Transportation
132	4853	Taxi and Limousine Service
133	4854	School and Employee Bus Transportation
134	4855	Charter Bus Industry
135	4859	Other Transit and Ground Passenger Transportation
136	4862	Pipeline Transportation of Natural Gas
137	4869	Scenic and Sightseeing Transportation, Land
138	4871	Scenic and Sightseeing Transportation, Water
139	4872	Scenic and Sightseeing Transportation, Other
140	4879	Support Activities for Air Transportation
141	4881	Support Activities for Rail Transportation
142	4882	Support Activities for Water Transportation
143	4883	Support Activities for Road Transportation
144	4884	Freight Transportation Arrangement
145	4885	Other Support Activities for Transportation
146	4889	Postal Service
147	4911	Couriers and Express Delivery Services
148	4921	Warehousing and Storage
149	4931	Scenic and Sightseeing Transportation, Land
150	5111	Newspaper, Periodical, Book and Directory Publishers
151	5112	Software Publishers
152	5121	Motion Picture and Video Industries
153	5122	Sound Recording Industries
154	5151	Radio and Television Broadcasting
155	5152	Cable and Other Subscription Programming
156	5171	Wired Telecommunications Carriers
157	5172	Wireless Telecommunications Carriers (except Satellite)
158	5174	Satellite Telecommunications
159	5179	Other Telecommunications

160	5182	Data Processing, Hosting, and Related Services
161	5191	Other Information Services
162	5211	Banca central
163	5221	Commercial banking
164	5222	Nondepository Credit Intermediation
165	5223	Credit unions and savings institutions
166	5224	Other Nondepository Credit and Finance Intermediation Institutions
167	5225	Services relating to non-depository credit intermediation
168	5231	Securities and Commodity Contracts Intermediation and Brokerage
169	5232	Stock market
170	5239	Other Financial Investment Activities
171	5241	Insurance Carriers
172	5242	Agencies, Brokerages, and Other Insurance Related Activities
173	5311	Lessors of Real Estate
174	5312	Offices of Real Estate Agents and Brokers
175	5313	Activities Related to Real Estate
176	5321	Automotive Equipment Rental and Leasing
177	5322	Consumer Goods Rental
178	5323	Rental and leasing services
179	5324	Commercial and Industrial Machinery and Equipment Rental and Leasing
180	5331	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)
181	5411	Legal Services
182	5412	Accounting, Tax Preparation, Bookkeeping, and Payroll Services
183	5413	Architectural, Engineering, and Related Services
184	5414	Specialized Design Services
185	5415	Computer Systems Design and Related Services
186	5416	Management, Scientific, and Technical Consulting Services
187	5417	Scientific Research and Development Services
188	5418	Advertising, Public Relations, and Related Services
189	5419	Other Professional, Scientific, and Technical Services
190	5511	Management of Companies and Enterprises
191	5611	Office Administrative Services
192	5612	Facilities Support Services
193	5613	Employment services
194	5614	Business Support Services
195	5615	Travel Arrangement and Reservation Services
196	5616	Investigation and Security Services
197	5617	Services to Buildings and Dwellings
198	5619	Other Support Services
199	5621	Waste Collection
200	6111	Elementary and Secondary Schools

201	6112	Junior Colleges
202	6113	Colleges, Universities, and Professional Schools
203	6114	Business Schools and Computer and Management Training
204	6115	Technical and Trade Schools
205	6116	Other Schools and Instruction
206	6117	Educational Support Services
207	6211	Offices of Physicians
208	6212	Offices of Dentists
209	6213	Offices of Other Health Practitioners
210	6214	Outpatient Care Centers
211	6215	Medical and Diagnostic Laboratories
212	6216	Home Health Care Services
213	6219	Other Ambulatory Health Care Services
214	6221	General Hospitals
215	6222	Psychiatric and Substance Abuse Hospitals
216	6223	Specialty (except Psychiatric and Substance Abuse) Hospitals
217	6231	Nursing Care Facilities (Skilled Nursing Facilities)
218	6232	Residential Intellectual and Developmental Disability, Mental Health, and Substance Abuse Facilities
219	6233	Continuing Care Retirement Communities and Assisted Living Facilities for the Elderly
220	6239	Other Residential Care Facilities
221	6241	Individual and Family Services
222	6242	Community Food and Housing, and Emergency and Other Relief Services
223	6243	Vocational Rehabilitation Services
224	6244	Child Day Care Services
225	7111	Performing Arts Companies
226	7112	Spectator Sports
227	7113	Promoters of Performing Arts, Sports, and Similar Events
228	7114	Agents and Managers for Artists, Athletes, Entertainers, and Other Public Figures
229	7115	Independent Artists, Writers, and Performers
230	7121	Museums, Historical Sites, and Similar Institutions
231	7131	Amusement Parks and Arcades
232	7132	Gambling Industries
233	7139	Other Amusement and Recreation Industries
234	7211	Traveler Accommodation
235	7212	RV (Recreational Vehicle) Parks
236	7213	Rooming and Boarding Services
237	7221	Full-service Restaurants
238	7222	Self-service, Takeaway food and other limited-service restaurants

239	7223	Caterers
240	7224	Nightclubs, Bars and Drinking places (Alcoholic Beverages)
241	8111	Automotive Repair and Maintenance
242	8112	Electronic and Precision Equipment Repair and Maintenance
243	8113	Commercial, Industrial and Agricultural Equipment Repair and Maintenance
244	8114	Personal and Household Goods Repair and Maintenance
245	8121	Personal Care Services
246	8122	Dry-cleaning and Laundry Services
247	8123	Funeral Homes and Funeral Services
248	8124	Parking Lots and Garages
249	8129	Other personal services
250	8131	Commercial, Recreational and Professional Organizations
251	8132	Religious, Political and Civic Organizations
252	8141	Households with domestic employees
253	9311	Legislative Bodies
254	9312	Public Administration
255	9313	Regulation and Promotion of Economic Development
256	9314	Justice, Security and Public Order
257	9315	Regulation and Promotion of Environmental Protection
258	9316	Social Welfare Institutions
259	9317	Foreign Affairs
260	9318	National Security
261	9321	International and Extraterritorial Organizations

A.3.2 Input-Output Table

What is an Input-Output Table?

An Input-Output Table is a double-entry table which contains information about how production in each economic sector of a region or country is generated, both in terms of purchasing of inputs or payments (column) and in terms of sales or income (row). It depicts the productive structure of a region or country according to economic data. Its main components can be seen in Figure A.3.1.

Figure A.3.1 Structure of an Input-Output Table

	Economic sectors	**Final demand**	**Gross output**
Economic sectors	(1) Interindustry transactions Purchases and sales relationships between economic activities	(5) Sales of final products to households, government, investors and foreign sector	(1)+(5) Gross output of each economic sector
Imports	(2) Imported intermediate inputs	(6) Imported final products by households, government and investors	(2)+(6) Total imports
Payments to primary factors	(3) Payments to primary factors		(3) Payments to primary factors
Taxes	(4) Taxes on products and production net of subsidies	(7) Taxes on products net of subsidies	(4)+(7) Total taxes
Gross output	(1)+(2)+(3)+(4) Gross output of each economic sector	(5)+(6)+(7) Value of each final demand components	Note that sum by column or by row, we get: (1)+(2)+(3)+(4)+(5)+(6)+(7)+(8)

Source: made by the authors.

A.3.3 Foundations of the Input-Output Analysis

A.3.3.1 Input-Output Model

Leontief's model specifies intersectorial purchases and sales relationships. It assumes that production exhibits constant returns of scale. That is, in order to produce each sector needs both intermediate and primary inputs in fixed proportions (constant technical coefficients) as well as homogeneity in the economic activities included in each sector. It also assumes that changes in strategic variables (final demand or value added) are exogenous and that the relationships between variables are static.[17]

Demand Model

The demand model is specified using the rows in the input-output table, assuming that final demand is a strategic and exogenous variable. This allows us to calculate the effect of an increase or decrease that final demand has on sectorial gross ouput.

This model can be conceived in two different ways: open and closed. The **open model** considers only the part of the IO matrix that corresponds to intersectorial transactions and is expressed as follows:

$$x = (I - A)^{-1} y$$

Where:

$x =$ Vector (nx1) of total gross output by sector.

[17] See Leontief, W. (1941): "The Structure of American Economy, 1919-1924: An Empirical Application of Equilibrium Analysis". Harvard University Press, Cambridge, Mass.

$A =$ Matrix (nxn) of technical coefficients and its elements are $a_{ij} = x_{ij} / X_j$

$y =$ vector (nx1) of final demand by sector.

The technical coefficients indicate the ratio of purchases of sector j from sector i in terms of the gross output of sector j. Matrix $(I - A)^{-1}$ is called the Leontief inverse matrix. Its elements are represented by α_{ij} and are interpreted as the additional quantity produced by sector i if the final demand for sector j increases by a unit.

On the other hand, the **closed model** considers that one of the one of the components of final demand is endogenous. The matrix is normally created with private consumption (column) and wages as an offset (row), resulting in (n+1) columns and rows.

The key in this specification is that it enables the addition of induced income effects through wages. As a result of the income effect, private consumption increases and, consequently, production expands.

Supply Side Input-Output Model

The exogenous variable of this model is value added. Therefore, we can observe the effects on total gross output generated by changes in value added of a particular activity. It is expressed:

$$x' = g'(I - D)^{-1}$$

Where:

$x =$ Vector (nx1) of total gross output by sector.

D = Matrix (nxn) of allocation coefficients, whose elements are represented by:

$$d_{ij} = \frac{x_{ij}}{x_i}$$

$g =$ Vector (nx1) of value added by sector.

The allocation coefficients indicate the ratio of sales from sector i to sector j in terms of the total sales of sector i. On the other hand, the elements of the Output Inverse Matrix $(I - D)^{-1}$, are personalized by δ_{ij} and are interpreted as the additional quantity produced by sector j when the value added for sector j increases by a unit.

A.3.3.2 Multipliers: Output, Income and Employment

Multipliers of the Demand Driven Input-Output Model

These multiplies measure the effects that an expanding sector has on those sectors that supply it with resources. They are used in the analysis of sector impacts and are derived from the elements of the Leontief inverse matrix. Given the assumptions of this model, they are linear. Depending on the effects, they are classified as being simple and total. The simple ones are those that only include direct and indirect effects calculated with the demand driven open model. On the other hand, the total multipliers add the induced effects and come from the closed input-output model with respect to households (overlined coefficients).

The most widely-used multipliers are the following: output, uniform expansion of final demand, income and employment.

The output multiplier for sector *j* is the value of total production of all the sectors in the economy that are needed to yield a one unit increase in final demand for sector j. It is obtained by adding the elements in the columns of Leontief's Inverse Matrix, and is equal to:

$$O_j = \sum_{i=1}^{n} \alpha_{ij}$$

The multiplier of a uniform expansion of final demand for sector i is obtained by adding the elements in the rows of Leontief's Inverse Matrix and is interpreted as the total production of sector i needed to achieve an increase in the final demand for all sectors.

$$O_i = \sum_{j=1}^{n} \alpha_{ij}$$

The income multiplier for sector *j* measures the increase in income of the whole economy generated by an increase in autonomous spending (government spending, investment or exports) in sector *j*. It takes into account the effects induced by labor income-private consumption relation.

$$\bar{O}_j = \sum_{i=1}^{n+1} \bar{\alpha}_{ij}$$

The employment multiplier measures the increase in employment in all the economy associated with an increment in the final demand for sector j. It is computed by pre multiplying the elements of Leontief's Inverse Matrix by a row vector, which contains the labor requirements per gross output for each sector j:

$$E_j = \sum_{i=1}^{n} l_{n+1} \alpha_{ij}$$

Where l_{n+1} is the number of workers in sector j per unit of gross output of sector j.

A.3.4 Classification of the Economic Sectors

The simple output multiplier of sector j is a measure of the total backward linkages of sector j. While, the uniforme expansion of final demand multiplier of sector i is an indicator of the total forward linkages of sector i.

In order to classify the economic sectors according to their total backward and total forward linkages, it is convinient to normalize the multipliers of a given sector with respect to the average multiplier of the economy. Therefore, we can calculate the following indexes.

Normalized total backward index of sector j:

$$U_j = \frac{O_j}{\frac{1}{n}\sum_{j=1}^{n} O_j}$$

Normalized total forward index of sector i:

$$U_i = \frac{O_i}{\frac{1}{n}\sum_{i=1}^{n} O_i}$$

Table A.3.2. Economic sectors classification by backward and forward linkages

		Total forward linkages	
		Low (U_i<1)	High (U_i>1)
Total backward linkages	Low (U_j<1)	Generally independent	Dependent on interindustry demand
	High (U_j<1)	Dependent on interindustry supply	Generally dependent

Source: made by the authors based on Miller and Blair (2009).

A.3.5 Hypothetical Extraction Method

The hypothetical extraction method allows us to quantify the weight of the Non-Alcoholic Beverage Industry in Mexico.[18] This method can be described as follows. Given the level of activity among all of the economy's productive sectors, there are multiple intermediate transactions that link the economic system. If the production of one of the sectors in questions was to be replaced by imports and, as a result, said sector stopped producing, these links must also be cancelled out. According to this hypothesis, the difference between the total linkage, generated within the productive chain at the beginning, and that generated after the disappearance of an industry, correspond to the linkage effects that are attributable to a given activity. This is the idea on which the hypothetical extraction method for sectors is based. A sector or group of sectors is eliminated from the system and then the

[18] Schuschny A.R. (2005). Tópicos sobre el Modelo de Insumo-Producto: teoría y aplicaciones. División de Estadística y Proyecciones Económicas. Serie estudios estadísticos y prospectivos 37, Santiago de Chile, CEPAL.

differences between both situations (pre and post extraction) are compared.

This method is based on a counterfactual question: what would happen to the structure of the economy if a sector or group of sectors disappeared? This idea was proposed first by Gurther Stassert in 1968.

Based on the input-output model:

$$x = (I - A)^{-1} y$$

The column(s) and row(s) corresponding to the sector or sectors in question are extracted from Matrix A (technical coefficient matrix). In this case, the rows and columns corresponding to the non-alcoholic beverage industry were eliminated. The following is obtained:

$$\check{x}(k) = \left(I - \check{A}(k)\right)^{-1} \check{y}(k)$$

Where $\check{A}(k)$ is the technical coefficient matrix without the kth column and row, $\check{x}(k)$ and $\check{y}(k)$ are vectors of n-1 rows. Given that y and $\check{y}(k)$ must be satisfied: $\check{x}_i(k) \leq x_i \ \forall \ i = 1, \dots, k-1, k+1, \dots, n$. Therefore, the sum of the differences:

$$L(k) = \sum_{i=1, i \neq k}^{n} (x_i - \check{x}_i(k))$$

can be considered to a measure of the linkage of the kth sector with the rest of the economy.

This type of analysis is valid when we wish to carry out an in-depth analysis of a specific sector or group of sectors. Obviously, there are two problems with this methodology. On the one hand, it is impossible to distinguish between forward or backward linkages. On the other hand, the hypothesis of extracting a complete sector from the system overly simplifies the situation.

Appendix for Chapter 4

A.4.1 Input-Output Price Model

The main characteristics of this model are the following. It considers 261 economic sectors, all of which have Leontief's production functions and constant return to scale. Furthermore, all the economic sectors are perfectly competitive. This is why firms take decisions considering that prices are fixed, that is, they have no power to affect them. Among the 261 economic sectors, the NAB sector is considered to be exogenous. Hence, the model produces a system of unit production cost linear equations, which given the assumption of perfect competition coincide with sector prices.

A representative household is modeled using a two-steps optimization process. In the first step, the representative household chooses consumption and savings in order to maximize utility subject to a budget constraint. We assume a Cobb Douglas utility function. In particular, we assume that this function is homogeneous of degree one. In the second step, households choose how much of each of the final goods to consume. In this process, they minimize expenditure on consumption subject to given utility level. As a result, we obtain demand equations for each one of the final goods sold by the 261 economic sectors. The price elasticities of demand are unitary. More details of this model are explained below.

A.4.1.1 Unitary Cost Functions: Prices

The input-output model assumes that each sector produces a unique good or service through a Leontief production function with constant returns to scale, using the following in fixed proportions: intermediate inputs (domestic and imported) and primary inputs (labor and capital). This model is formulated using the intrinsic relationships of an Input-Output Table (IOT), which is presented in terms of values. It follows that the production function of

sector j is:

$$(1)\ Y_j = Min\left\{\frac{x_{1j}}{a_{ij}},...,\frac{x_{261j}}{a_{261j}},\frac{xm_j}{m_j},\frac{REM_j}{l_j},\frac{GC_j}{k_j}\right\}$$

Where Y_j is the gross output of sector j; x_{ij} is the value of purchases of intermediate goods by sector j from sector i; xm_j is the value of the intermediate imports pertaining to sector j; a_{ij} is the proportion of gross output that sector j uses to purchase intermediate goods from sector i (better known as the technical coefficient); m_j is the proportion of gross output that sector j uses to purchase imported intermediate inputs (technical import coefficient); REM_j are wages paid by sector j; GC_j are payments to capital by sector j; l_j is the proportion of gross output that sector j uses to pay the labor factor; and, k_j is the proportion of gross output that sector j uses to pay the capital factor.

Based on these assumptions, the benefits generated by each sector are zero and, as such, the price of the merchandise for each sector is equal to the after-tax unitary cost:

$$(2)\ p_j = \sum_{i=1}^{261} p_i a_{ij} + pm_j m_j + wl_j + rk_j + t_j p_j$$

Where pm_j is the price of the intermediate goods imported by sector j; w is wage, r is rent to capital and t_j is the effective tax rate on products and production (net of subsidies) paid by sector j.

In order to analyze the effect of a change in the price of non-alcoholic beverages, this sector will be set as exogenous and its price equal to one in initial equilibrium. The n economic sectors will be divided into: the non-alcoholic beverage sector, which will be identified using sub-index B, and q endogenous sectors (the remaining 260 sectors), which will be identified using sub-index R. The expression for the price of the n economic sectors is then:

$$(3)\ \begin{bmatrix} p_B \\ p_R \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ A'_{BR} & A'_{RR} \end{bmatrix} \begin{bmatrix} p_B \\ p_R \end{bmatrix} + \begin{bmatrix} 0 \\ cim_R \end{bmatrix} + \begin{bmatrix} 0 \\ v_R \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

Where p_B is of order (1x1) and contains the price of the non-alcoholic beverage sector which is fixed to be one, p_R is a column vector (qx1) which includes the prices of all the endogenous sectors, A_{BR} is the technical coefficient vector of the endogenous sectors for inputs from the non-alcoholic beverage sector (1xq), A_{RR} is the technical coefficient matrix of the endogenous sectors for the inputs they supply themselves (qxq), cim_R is a column vector (qx1) and its elements are intermediate consumption per output unit of the endogenous sectors, v_R is a column vector (qx1) which contains the value added per output unit of the endogenous sectors.

The imported intermediate consumption per output unit will be specified in the following manner:

$$(4)\ \begin{bmatrix} 0 \\ cim_R \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & m_R \end{bmatrix} \begin{bmatrix} pm_B \\ pm_R \end{bmatrix}$$

Where pm_B is a vector of order (1x1) which contains the price of the intermediate imports from the non-alcoholic beverage sector, $pm_{R\ is}$ a column vector (qx1) which presents the prices of the intermediate goods being imported by the endogenous sectors, $m_{R\ is}$ the diagonal matrix of order (qxq) containing the technical coefficients of the endogenous sectors with regard to intermediate imports.

Similarly, value added is divided into its components:

$$(5)\ \begin{bmatrix} 0 \\ v_R \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & l_R \end{bmatrix} w + \begin{bmatrix} 0 & 0 \\ 0 & k_R \end{bmatrix} r + \begin{bmatrix} 0 & 0 \\ 0 & t_R \end{bmatrix} \begin{bmatrix} p_B \\ p_R \end{bmatrix}$$

Where l_R, k_R *y* t_R are diagonal matrices (qxq), with the diagonal being the proportions that wages, gross operating surplus and tax represent in the gross output of the endogenous sectors, respectively.

It is assumed that the wage (w) and the rent of capital (r) are equal for all economic sectors.

Furthermore, it is assumed that rent of capital is fixed. Wages are modeled as follows:

$$(6)\ w = 1 + gi * H\Delta p$$

Where *H* is a vector (1xn) that contains the share of total spending on consumption earmarked for final goods or services *i*; Δp is a vector (nx1) that includes the change in prices of final services or goods *i;* and, *gi* is a scalar which indicates the degree to which wages are indexed, where 0 implies that they are not indexed (i.e., wages are exogenous in the model) and 1 indicates that they are 100% indexed (that wages are endogenous).

In the initial equilibrium, wages, rent of capital, the prices of imported goods and sector prices are equal to one. Therefore, if we want to see the effect of a change in wages, the rent of capital, indirect taxes or the price of imports, we incorporate this change in the equations and calculate new prices.

In the model that we use, there is only one exogenous sector, which is the NAB sector. Hence, we consider the change in the price of NAB that results from the tax, then we recalculate the model and observe the effects on the prices of all sectors. It is important to mention that two simulations are carried out. In the first simulation, wages are fixed, which means gi=0, while, in the second simulation, wages are 100% indexed to the CPI, which means that gi=1.

A.4.1.2. Consumption Demands

As explained before, the preferences of the representative household are described by a Cobb Douglas production function which is homogeneous of degree one. As a result, consumer demands for goods are:

$$(7) C = Mp^{-1} * \alpha * ing$$

Where *C* is a vector of order (nx1) which contains the extent of the demand of the representative household for each one of the *n* consumption goods; Mp^{-1} is a diagonal matrix (nxn) whose main diagonal shows the inverse of the prices of the consumption goods; α is a

vector of order (nx1) and its elements are the average propensities to consume on each good *i* of the representative household*;* and, *ing* is a scalar that represents household income.

Household income is composed of labor income and capital income:

$$(8)\ ing = w * e * L + r * e * K$$

Where e is a row vector of order (1xn) of ones; L is a column vector of order (nx1) with the wages and salaries paid by each economic sectors; and, K is a column vector of order (nx1) with the gross operating surplus paid by each economic sector.

A.4.2 Impact on Output, Employment and Labor Income

In order to estimate the effect of a reduction in private consumption (resulting from the tax) on output, employment and labor income in the country, we will use some of the multipliers calculated in Chapter 3. That is, we will use the output and employment multipliers previously calculated and a variant of the labor income multiplier. We will use a variant of this multiplier because the one obtained from Leontief's Closed Model considers that private consumption and labor income are endogenous. In this exercise, private consumption is exogenous. Therefore, it is methodologically correct to apply a Type I income multiplier which is calculated in the following manner:

$$(9)\ \mathrm{MI} = ingl * (I - A)^{-1}$$

Where MI is a vector of order (1xn) with the Type I income multipliers; *ingl* is a vector of order (1xn) which contains the proportion of gross output that each sector uses to pay wages and salaries; and, $(I\text{-}A)^{-1}$ is Leontief's Inverse Matrix.

A.4.2.1 Simulation 1 Assuming that Price Elasticity of Demand is -0.26

The first simulation deals with the effects of a reduction in consumption of non-alcoholic beverages caused by the tax. This reduction is calculated with a partial equilibrium model (ΔC_{EP}). The multipliers of output, employment and labor income within the NAB sector are then applied to this quantity.

(10) $\Delta prod_{EP} = O_B * \Delta C_{EP}$

(11) $\Delta emp_{EP} = \varepsilon_B * \Delta C_{EP}$

(12) $\Delta ing_{EP} = MI_B * \Delta C_{EP}$

Where $\Delta prod_{EP}$ is a vector of order (nx1) and its elements are the change in gross output of each sector *i* generated by a decrease in consumption of NABs; Δemp_{EP} is a vector of order (nx1) and its elements are employment in each sector *i* generated by a decrease in consumption of NABs; Δing_{EP} is a vector of order (nx1) that contains the change in labor income in each sector *i* generated by a decrease in consumption of NABs; O_B is a vector of order (nx1) which represents the effect on the output of sector *i* when the final demand for NABs increases by one unit, considering intersectoral relationships to be endogenous; ε_B is a vector of order (nx1) which contains employment linked to the increase in the output of sector *i* when the final demand for NABs increase by one unit, taking intersectoral relationships into consideration; MI_B is a vector of order (nx1) and its elements are labor income linked to the increase in output of sector *i* when the final demand for NABs increase by one unit, in a multisectoral context.

A.4.2.2 Simulation 2 Assuming that Price Elasticity of Demand is -1

The only difference with simulation 1 is that the price elasticity of demand for NABs is assumed to be unitary (ΔC_{EG}).

(13) $\Delta prod_{EG} = O_B * C_{EG}$

(14) $\Delta emp_{EG} = \varepsilon_B * C_{EG}$

(15) $\Delta ing_{EG} = I_B * C_{EG}$.

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