



ANALYSING THE EFFECTS OF SUGAR SWEETENED BEVERAGES' TAX

ABSTRACT:

This research tries to analyse the effects that tax on sugar sweetened beverages have on population's health. Based on several investigations it is argued the relation found between high sugar intake and obesity, type 2 diabetes and other non-communicable diseases. It has been observed that this usually affect more notoriously children and young people than adults. It is estimated capability of the tax to reduce notably the consumption of this product due to a price elasticity close to the unity. It is also observed the behaviour of the demand and the effects that has had on health the introduction of the tax in others in other countries. The aim of this research is to examine the previous literature about sugar sweetened beverages taxation, the potential impact on its intake and the consequent reduction of overweight, obesity and other non-communicable diseases.

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1. Introduction

It has been largely demonstrated that the excess consumption of sugar sweetened beverages or SSBs which World Health Organisation defines as *“beverages containing added caloric sweeteners, such as sucrose, high-fructose corn syrup, or fruit-juice concentrates. These include, but are not limited to, carbonates, fruit drinks, sports drinks, energy and vitamin water drinks, sweetened iced tea, and lemonade”* (Malik et al, 2013; Bray et al, 2010; Hu, 2013; Ruyter et al., 2012), as well as high caloric foods which contain great levels of saturated fats, trans-fatty acids, free sugars and/or salt, by themselves or in combination with insufficient physical activity, contribute to obesity and diabetes, and other NCDs. This usually affect more notoriously children and young people than adults. Obesity is a world-wide health problem and one of the NCDs that affect most people aside from diabetes, some types of cancers and heart diseases (WHO, 2002; WHO, 2008). Some years ago these diseases had only an important impact on countries where population incomes were higher, despite of that, nowadays its presence is increasing in poor countries too. The WHO (2005) defines this fact of being possible to find in a country with remarkable rates of obesity and at the same time malnutrition as the “Double Burden of Disease”.

Concerning daily life and habits several changes has happened during last decades which have been empowered by the improvement of transport of food and communication. As a result of these alterations, our lifestyle has been modified by increasing people’s amount of calories and reducing the time we dedicate to physical activities, and this in turn has led to increment general Body Mass Index, which is a relation between the high and weigh of a person to determinate, by using some ranges, if the studied one has a correct mass (Swinburn, 2011; Chaput, 2009).

A survey by Murray et al. (1997) related this lifestyle changes (worst diet and less sport practiced) in the two last decades with a notable raising in the number of NCDs around the world, and a reduction of health quality in terms of Disability Adjusted Life Years (DALY) what would equal to the impact of death and disability that an specific disease is able to generate (Lim SS et al., 2010). One of the biggest problems that health must deal with mostly in countries in way of being developed are the non-communicable diseases or NCDs. WHO defines non-communicable diseases, calling it chronic diseases too, as the ones which cannot be spread among people. This illness have usually a long-term and a slow advance. Some examples of them are obesity, cancer or cardiovascular problems which in this developing countries are almost 85% of deaths for this cause. It affects to developed countries too, in fact the quantity of people who die

annually from NCDs amount to 36 million (almost two thirds of global deaths) where more than a third of that (14 million) are people between 30 and 70 years old. In fact diabetes caused 1.5 million deaths in 2012 and almost 90 DALYs. A great part of deaths caused by NCDs could be avoided if agents in charge of population's health such as governments, following World Health Organization advices, established public measures which changed people's behaviour. It would be beneficial to public health to prevent some harmful conducts such as tobacco smoking or too high consumption of sugar and alcohol and to promote others as increasing the quantity of fruits and vegetables on diets.

Evidences (Chriqui et al., 2008) show that tax on SSBs reduce its consumption, and because sugary beverages consumption has been demonstrated to be related to weight gaining, it led researchers to assume taxing SSBs must reduce population's obesity. Thus, these measures have been proved to be effective, but its power depend on how useful are substitutive goods. It is due to there has to exist some good that does not contain a similar amount of calories so that the consumer do not have to change sugary drinks for food or drink that fattens the same or more.

Assuming adult population as the one between 25 and 64 years old it has been estimated that: The percentage of people who is overweight in Spain is 39'3% and the obesity's is 21'6% and this average increases as people get older. Obesity rates in Spain are high enough to consider it a national health problem, however it exist differentiated distribution depending on Autonomous Communities. While in Asturias and Galicia obesity reaches rates of 25'7% and 24'9%, what can be compared to developed countries with a very high rate such as US, where they suffer a 28% rate (Prentice, 2006), in Cataluña is just a 15'5% and in Baleares it falls down to 10'5% (Aranceta-Bartrina, 2016).

In order to reduce the consumption of some particular foods which deteriorate people's health is a useful solution to implement a system of taxes and subsidies with which governments are able to improve individual's diet. The observation of all the available information suggests a significant increase in weight rates, indicating the need for systematic monitoring and integrated actions. These actions are part of a group of policies that are being more and more common since the obtained by introducing tobacco taxes. Nowadays there are a huge number of evidences that ratify fiscal policies effectivity significantly referring to sugar-sweetened beverages (Lusting et al., 2016). This fact makes charging this drinks such a good measure to fight the obesity and diabetes epidemic the world actually suffer.

The aim of this dissertation is to examine the previous literature about sugar sweetened beverages taxation and the potential impact on its intake and the consequent reduction of overweight, obesity and other non-communicable diseases. It will be taken an overview of the relation between sugar sweetened beverages to overweight, obesity and other NCDs, ratified its existence and given possible solutions.

2. Sugar as a public health problem

2.1 How do affect sugar excess on health

Excessive sugar intake have been proven to have negative effects on health further than just be a problem on individual's weight. In words of WHO (2013), it affect significantly to our bodies increasing probabilities of suffering non-communicable diseases through the metabolic syndrome, a group of conditions that put health at risk of enduring these diseases. Among these illnesses there can be found hypertension, hypertriglyceridemia (what refers to a too high level of fats in the bloodstream) or diabetes. It has been observed by Lusting (2010) among others that harmful effects of sugar on liver are suspiciously likely to the ones that alcohol has, due to the fact that alcohol comes from sugar fermentation.

As it will be expanded afterwards, sugar acts as a drug of abuse in the sense that dopamine, which is a neurotransmitter that gives to the brain a positive reinforcement every time some pleasant fact happens, start acting when we consume this product. It becomes a health problem when dopamine reduces its intensity with the pass of time and the prolonged consume, what will make necessary more sugar to obtain the same pleasure level. This supposes that sugar's dependence increases the more it does its intake (Lusting, 2010). It has been observed (Willett et al., 2013) that consuming sugar sweetened beverages has the additional issue of do not producing the feeling of satiety comparing it with solid sugar, what increases the intake more than it would be recommendable.

In the year 1990 professor Philip James, WHO's Technical Director of Nutrition, was asked to establish the healthy minimum and maximum limits for consumption of added sugar. The result of the study showed that this should be between 0% and 10% of daily calories, what supposed not only a restriction of the intake of added sugar and sweetened products but also that in a regular diet it was not necessary (Hermann et al., 2012).

2.2 Addictive nature of sugar: Sugar as a drug of abuse

Commonly investigations about addictive drugs are interested in the study of cocaine, nicotine or alcohol. But some researchers change their point focusing in other types of addiction coming from non-drug stuff such as gambling, which started being considered a psychological disorder in the 80's, or in this research's case, sugar. This last has been studied since late 80s (Hoebel et al., 1989), but there is not already an agreement among scientist about recognizing its addiction, because, despite the large number of proofs, it has just been studied recently (Avena et al., 2005). There exist many clinical books that focus on sugar addiction concept specially the ones that deal with diet programs. Usually in this kind of research, when foods with high sugar content are highly reduced, there can be observed withdrawal symptoms. This studies, such as Appleton (1985) talk about how, depriving the intake of some kinds of food can cause some symptoms of dependence, what instead of reducing patients' weight trigger the chances increasing of suffering obesity.

A concrete research (Colantuoni et al., 2001) studied in a laboratory the conduct of a group of rats that were fed intermittently with sugar. They were given to drink a 10% sweetened solution as long as they wanted during 12 hours per day and the other half of the day this substance was deprived. This experiment had normally a duration of 3 weeks and animals were given the sugared solution in very concrete hours to maximize its consumption, in order to be able to observe clearer results. When these rats were compared with the control group it was observed that the ones fed intermittently with the sweetened liquid started present with many symptoms related to drug of abuse dependence, both behavioural and neurochemical, in terms of acting ways and how brain works. The term addiction can be used in some cases as a synonym of dependence, because the irrepressible need of a substance, such as sugar, will make the individual look for it impatiently, what is the addiction itself (Nelson et al., 1982).

So these is the reason why the consumption of this products is clearly unhealthy, but there is a cause because everyone like sugar that much. That is because it can activate some centre of pleasure in our brain, thing that happens too when addictive drugs such as alcohol, marihuana or cocaine are used (Lusting, 2010). WHO defines the term addictive drugs as the "use of a psychoactive substance or substances, to the extent that the user is periodically or chronically intoxicated, shows a compulsion to take the preferred substance, has great difficulty in voluntarily ceasing or modifying substance use. Typically, tolerance is prominent and a withdrawal syndrome frequently occurs

when substance use is interrupted” Due to the similitudes found between sugar and other drugs of abuse, sugar addiction has been started to be investigated (Avena et al., 2008).

Obesity and overweight high rates started to become something clearly observable as an extended disease in the 80s, and from that day to actuality it has been increasing to more than double (Ng et al., 2013). It has been largely proved that the excess consumption of sugar-sweetened beverages such as added sugar and fructose is strongly related to be likely to suffer obesity, diabetes and other NCDs (Bray et al., 2014). One of the first times a link between SSBs and weight increasing was suggested occurred in the year 2001, when a study by Ludwig et al. (2001) focused specially on childhood obesity, and then it has been followed by many others corroborating the evidences.

2.3 Lobbying influence on sugar market

Trying to understand better the concept of lobbying, the definition given by the European Union can be used, which is used for “those activities done with the aim of influencing the formulation of public policies and the decision-making processes of the Institutions” (Lehmann et al., 2003). Although there exists an objective difficulty in investigating this concept, due to its lack of regulation, it is not surprising that the major advances in the definition and professionalization of lobbying are taking place at a moment like the present one, in which society looks for an improvement of democracy, greater participation of the public in public policies and improved transparency of decisions. Lobbies are entities that carry out influence work in a professional manner. They are therefore groups of companies engaged in representing and defending interests, commercial organizations representing profit-seeking societies, professional associations and trade unions representing the interests of workers or professions (Vélmez et al., 2014).

In the case of sugar sweetened beverages, a press investigation (Hermann et al., 2012) found that some companies created relationships with medical laboratories by financing some of their researches with the intention of having official studies made by members of these entities (doctors, nutritionists or statesmen specialized in the subject) in which they will be able to base the defence of a product in terms of healthiness from other investigation about sugar effects which could harm their product’s opinion to public organisms and consumers. If there existed restrictions or sanctions on added sugar quantity that products could have, food producers would be forced to reduce it, but as

Avena et al. expressed (2008) sugar is cheap, it is tasty and gives our brain a powerful positive reinforcement which makes it so easily sold companies have no incentives to change it.

A study which searched for lobbying actuation (Aaron et al., 2017) observed that, between the years 2011 and 2015, 95 health organization had been financed only in US by the two main soda companies Coca-Cola Company and PepsiCo, separately or both together. During these four years 29 of all organizations that were given some economic fund meanwhile a law which intend to reduce the intake of soda was proposed. In this study it was explained the high and normalized level of lobbying there exist and how, by accepting being financed by this firms, health organization is helping their marketing programmes. Another interesting fact that shows more information about lobbying is that out of 21 EFSA (European Food Safety Authority) nutrition experts, 13 have reported to have links to food sector companies (Hermann et al., 2012). Other example of lobbying actuation was pointed by Krisberg (2016) where the group Save the Children whose one of its main objective is to improve health condition in kids all over the world and had made several efforts trying to introduce taxes on SSB's stopped its intervention after accepting 5 million dollars from these two companies.

The food multinationals usually organize talks and fairs on obesity, diabetes and some other diseases caused by the consumption of sugar, what appear to be paradoxical. It would be absurd that a tobacco company give talks about lung cancer, situation that, even though empirical evidences that relate elevate sugar consumption with many NCDs, is happening in sugar sector. The intention of denying these accusations pass through invite doctors and nutritionists to this evets trying to be these ones who give a good image of the sector (Hermann et al., 2012). In France it exists CEDUS (Center d'Études et de Documentation du Sucre), an organization that encompasses all the companies that produce and treat sugar, whose goal is to research and document information on sugar plants, as well as sugar qualities and its consumption patterns (CEDUS). This organization make statements such as "there is no evidence that any specific food, food ingredient or food additive causes addiction" or "the brain does not respond to nutrients (sugar, salt, fat) in the same way as drugs". They deny these accusations that indeed has been proven to be truth (Lusting et al., 2010; Avena et al., 2008).

In the year 2013 had place an international conference on health promotion where the WHO's General Director, Dr. Margaret Chan, a public figure and one of the most important experts in the health field nowadays, explained some important facts

about sugar lobbying and how they play an important role in public decisions which finally affect population welfare. In her speech she compared the sugar industry's tactics with those that big tobacco companies followed for years to hide the scientific evidence of how noxious was smoking for their health. Nowadays attitude to sugar reminds to the one it was had with tobacco in the early 1960s, so no one talked about tobacco addiction and nicotine was not considered addictive which did not prevent millions of people addicted to tobacco, with all the consequences we have known in the last 50 years (Ernest et al., 2001). Companies, as it is expectable, prioritise commercial interests rather than preventing non-communicable diseases, what she thinks to be a great challenge for health security. She concludes, explaining from her point of view the two main problems that public health has, that actually are the fact that some governments have been taken to court for introducing measures to protect the health of their citizens and, moreover the reality of industries who involved themselves in policy-making process, what detracts people's convenience in benefit of the companies. So organizations such as OMS, or national ones should stay unaffected by commercial or personal interests (Chan, 2013).

2.4 The governments' responsibility

Trying to overtake the exposed problem, governments have created and followed different effective policies capable of change this behaviour which may be harmful for health. In the case of Hungary this country introduced a measure known as fat tax the year 2011 taxing non-staple food which could carry health risks (Holt, 2011). Another case is Mexico, where in the year 2014 was implanted a special tax on beverages which contained sugar of roughly 1 peso per litre of soda, what means a 10% of the final product price (Colchero, 2016). Some states from USA established sugar sweetened beverages taxes and California which became the first city in the country to having a tax policy, imposing a 1 cent per ounce on SSBs (Falbe, 2015). Finland is a country well-known for using fiscal policies to modify food intake and one example of this is that for more than 50 years they offer free school meals, which are paid by tax income, (Sarlio-Lähteenkorva, et al., 2010) and university students receive subsidies for consuming healthy food. As it is explained by Pomeranz, et al. (2012) these countries are examples of those who have concluded that one of the best elections to reduce the ingestion of unhealthy food and drinks begins taxing SSBs, what combined with other fiscal policies is the way of reducing obesity.

Although it has been demonstrated that SSBs do not contain any nutritional value (Ng, et al., 2011; Caprio, 2012; Novak, 2011; Powell, 2009) in some countries it represents an important part of daily calories intake, what shows the people's lack of knowledge who are not aware of how harmful can excess of sugar be. An example of it is US, where SSBs suppose 11% of all calories for children and adolescents (Hu, 2013). These quantities of SSBs that these young people and anyone can consume are that high because of the easy access that exist, because it can be found everywhere.

Having on mind the fact that a several number of deaths caused by NCDs could be avoided if governments established public measures which changed people's behaviour, in the year 2013 the World Health Assembly took place in Geneva (WHO, 2013), where a group of representatives from many countries and the directors of the WHO accept the "*plan for the prevention and control of non-communicable diseases 2013–2020*" and established 9 main points they had to reach before the year 2015. Among this points where included: A 25% relative reduction in risk of premature mortality from NCDs or stopping the increase in diabetes and obesity. It has been calculated 39% of adults in the world (people aged higher than 18 years old) were overweight in the year 2014, while only half of them were 30 years before.

But it has been estimated by Apovian (2004) that obesity rates, which have been increasing in the same proportion as overweight since last 40 years (result of the same change of diet and physical activities), could be hugely reduced by a not so shocking effect on habitant's life. It was demonstrated that it could be reduced 100 daily calories, what would suppose a health improvement to almost every person involved, by only reducing the consumption of Sugar sweetened beverages in 1 can (33 cl.) per day. It would equal walking 1.6 km per day too. In a different study by Lusting et al. (2016) it was designed a clinical trial in which foods containing added sugar were removed from the diet of a group of obese youngsters of 9 to 18 years old with one or more symptoms of metabolic syndrome, and were replaced by other carbohydrates, rich in starch, while keeping the intake of calories at the same level. After 10 days, children showed dramatic improvements, despite losing little or no weight. On average, their cholesterol, diastolic blood press and triglyceride concentration (a contributor to heart disease) was reduce. And their fasting blood sugar and insulin levels (indicators of their diabetes risk) also improved.

So it must be assumed that even little changes in people's diet can be largely profitable for health at a not really high expense (Beaglehole et al. 2011) and as Cecchini expressed (2010), it is government task to find the optimum combination of incentives or

disincentives that maximizes population's health welfare. The fact that it is so easy to correct the causes of the overweight makes us consider measures must be implanted and it made some experts on the subject agree that solution was taxing foods or drinks which could augment possibilities of weight increasing. The tax effects will act first on the product, which price will rise making consumers reduce the quantity of SSBs in their goods basket what will make them have a lower added sugar intake and finally will reduce rates of overweight and obesity (Cawley, 2000).

3. Review of the literature

3.1 The tax usefulness

Obesity and overweight started to become something clearly observable as an extended disease in the 80s, and from that day to actuality it has been increasing until more than doubling the rates that were observable 30 years ago (Ng et al., 2009). Several studies such as Brownell et al. (2009) has demonstrated that consumption of any kind of sugar sweetened beverages is directly linked to obesity, diabetes, heart diseases and many others NCDs, what makes it an indisputable argument why to reduce it. During the year 2016 the WHO hardened its recommendation of start taxing all food and drinks that were considered unhealthy, such as sugar sweetened beverages, and subsidizing those which are better contribution in terms of calorie intake, like fruits or vegetables (WHO, 2016).

Relying on the favourable results that tobacco taxes had, the World Health Organization suggest to tax sugary drinks in order to reduce their intake in at least 20% (WHO, 2009). According to Brownell et al. (2009), implantation of this soft drinks' tax would produce two clear effects: the health benefits of the public, who are reducing the consumption on a harmful product, and the obtaining of the tax collection, that could be invested in health cares and, therefore, increase social welfare too. Some examples of countries that followed WHO's recommendations and had positive results were Mexico, whose tax reduced beverage's consumption by 12% (Colchero et al., 2016), and Berkeley (US) where intake in low-income householders was reduced in 21% (Falbe, 2016), both percentages reached after the first year of the measure.

3.2 How does tax affect consumer's behaviour: The demand elasticity

It is important to know how demand varies when the price changes (in this case as a result a tax): the elasticity, which admits both positive and negative signs but what is expected to have negative signs. Between 0 and -1, the demand is inelastic (a price increase of 10% means a reduction of the quantities consumed of less than 10%), which may be good news for the treasury authorities, but not for the health ones. Demands greater than -1, in absolute value, are considered elastic. A price increase of 10% leads to a decrease in the quantities consumed of more than 10%, in this case it will mean lower public collection and better news for health authorities, because it further reduces the consumption of the product that causes the harmful externalities. Having in this on mind it is essential to know the demand's elasticity of sugary drinks noticing whether it is elastic or not.

A study by World Health organization (WHO, 2015a) concluded that generally, demand for sugar sweetened beverages is elastic and it is usually around -0'9 and -1'3. It was found too that price elasticity is higher in some groups of society, who are: low-income consumers, who are more affected by a price change on soft drinks, because it supposes a greater part of their rent than the richer parts of population, and people with overweight, what by the way, is correlated to income, so it will affect to the wealthy sector of population. Finally, this research observed that high SSBs consumers are the most price-responsive.

A meta-analysis (Cabrera-Escobar et al., 2013) with data from three that have introduced special taxes on sugary drinks (France, Mexico and Brazil) showed a decrease in consumption and a decrease in overweight and obesity. The estimated price elasticity was -1.3 (95% CI: -1.1 to -1.5), what is an argument to suppose that demand may be elastic. In this study they justify the high elasticity they found by the fact that there are nearly perfect substitutes that are not taxed - the same soft drink in its light version or added sugar. Compared to the elasticity of the two other harmful consumptions - tobacco, alcohol - sugary drinks seem very reactive to price, so the tax is a more powerful lever in health policies. In another meta-analysis (Andreyeva et al., 2010) after reviewing the data obtained in 160 studies from the US with the aim of calculating price elasticity of demand for a great number food categories reached the conclusion that price elasticities for soft drinks ranged from 0'8 to 1 (absolute values) what suppose that a 10% increase in their price would decrease consumption by 8% to 10%. This is an example of a study that supports a not so elastic demand.

Practically all the researches and meta-analysis investigated confirm that taxing unhealthy food and drink in general, and sugar sweetened beverages in particular, are cost-effective measures and improves population's health reducing the calories intake and thus the chances of suffering obesity and other non-communicable diseases. Several studies conclude also that, in order to maximize the effect of the tax it has to be at least 20% of the product's price. In a meta-analysis made by WHO (WHO, 2015b), where the researchers observed were 11 reviews on the effectiveness of fiscal policies to prevent non-communicable diseases, it was concluded that the measure was strongest in health improve results when intake of SSBs was reduced by 20 to 50% while fruit and vegetables consumption were increased by 10 to 30%.

TABLE 1: Main observations of meta-analysis on fiscal policies

	Food / Beverage taxes	Nutrient-focused taxes	Subsidies
Effect on consumption	Strongest evidence for SSB taxes. Reduce consumption by same percentage as tax rate	Reduce consumption of target but may increase consumption of non-target nutrients; may apply to core foods, better if paired with subsidy.	Subsidies increase healthy food intake. Strongest evidence for fruit and vegetable subsidies.
Effects on body weight/disease outcomes	Substitution will affect total calorie intake. Most effective to target sugar-sweetened beverages. Limited evidence for disease outcomes.	Disease outcome affected by substitution. Nutrient profile taxes less likely to have unintended effects than single nutrient-based taxes.	Subsidies may also increase total calorie intake and body weight. Very likely to reduce dietary NCD risk factors.
Differential effects	May be most effective for low-income populations; may have greater effect on those who consume most.	May be more likely to have regressive effects as more likely to apply to core foods.	Mixed socioeconomic status effects for population subsidies, may benefit wealthy. Targeted low-income subsidies effective.

Source: World Health Organization (2015)

3.3 Empirical observations: Country experiences and lessons learned

Even though the best method to estimate the usefulness of the implementation of a tax in Spain is being calculated by its own datum, testing how affects the prices' changes on demand, it is necessary to observe how other countries have acted on it, so here is the case of some of them.

Equator

A recent study (Paraje, 2016) has estimated a price elasticity of -1.2 for sugary drinks in Ecuador, reaching values of -1.5 for the poorest 40% of the population. It may seem regressive that they bear the greatest tax burden but it is remarkable that in countries, such as Ecuador, where they have a great part of the health spending coming directly from the population's income the reduction of consumption will also benefit them economically in the future. Economic models calculated for other developing countries such as India (Basu et al., 2014) allow to conclude that taxes of the order of 20% on sweetened beverages reduce both obesity and type 2 diabetes.

Finland

Finland is a country that stands out in the use of fiscal and price policies to affect food intake of its population. The government is aware of the importance of taking care of young people's health and creating healthy habits and demonstrate it having free meals at schools which are financed by a tax over the income (Sarlio-Lähteenkorva, 2010). In the year 2010 it was discussed in the Finance ministry among three different kinds of models by introducing a tax on sugar content, incrementing one which already existed based on taxing some foods such as ice cream and sweets or combining the two together. The government realised that the combination would get the maximum benefit regarding to health care and the excise duty method would be more efficient in terms of convenience to introduce it (Finn ministry of finance, 2013). Nowadays in this country it exists a 0'95 €/kg tax for sweets and ice cream and non-alcoholic drinks have a charge of 0'11 €/l. In addition to these two special taxes (which are apart from VAT) drinks which proportion of more than 0'5% sugar have an extra supplement of 0'22 €/l (WHO 2015).

Mexico

The case of Mexico is of interest because it introduce a sugar sweetened tax in one of the countries with the highest overweight rate in the world (Trujillo-Hernández et al., 2010). On January 2014, a special tax of approximately one peso per litre of soft drink was introduced, which meant a 10% increase in its price. In order to find out the effect of the tax on the consumption of sweetened beverages in the year of applying the tax, a study (Colchero et al., 2016) carried out an observational study for 2 years, with 6,252 households providing 205,112 observations. The variables used in the analysis

included demographic information on household composition and socioeconomic status. The amounts of taxed and non-taxed beverages consumed in 2014 were compared with the forecast of the volumes that would potentially have been purchased if the tax had not existed on the basis of consumption trends before impose the tax.

Purchases of taxed beverages were reduced by an average of 6% until reaching a 12% drop after the first year of implementation. The three all socioeconomic groups in which were divided the study population (low, medium and high) reduced purchases of taxed beverages, but reductions were higher among households with a low socioeconomic level, with an average decrease of 9% (average 2014) to 17% in the last month of the year. Sales of duty-free beverages rose 4%, driven mainly by increased purchases of bottled water. It can be concluded that a long-term monitoring of drinks' purchases, the possible substitutions and their implications for health is necessary. It is expected that the purchase of soft drinks continue to fall in any country, so far as they are products that respond to a process of habit forming and that process changes abruptly when a shock occurs as the price increase due to the new tax.

United States of America

Sugar sweetened beverages are the principal food or drink source of sugar in the US, from where population intakes half of total added sugar it is consumed (DeSalvo et al., 2016) and this is one of the causes that make besity one of the problems that affect most severely the USA, where two thirds of its adult population are overweight, but it affects also children and adolescents (Smith et al., 2010). It was estimated (Brownell et al. 2009) that in the US a 1 cent per ounce tax would reduce consumption by 10% and generate a 15 thousand million dollars in one year. The same researchers stated that elasticity on demand was nearly -0'8 to -1.

Due to the recentness of the tax introduction for sugary, most investigations use simulations with estimates of price elasticity and consistently find that fiscal policies can reduce the consumption of sweetened beverages and generate public revenues. A couple of them (Long et al., 2015; Gortmaker et al., 2015), referring to the US, prove that the tax intervention is cost-effective. However, other estimates for the same country, where already two-thirds of states have some kind of specific tax policy on sugary soft drinks, are more pessimistic: taxes reduce the BMI of the population, but very little (Fletcher et al., 2010). In the USA usually legislative action are taken at the state or local level. An example of that was the state of California, which has established policies such

as the prohibition of selling SSBs on school campuses in 1999 or the fact that Berkeley, a city sited in this state, after overcoming some impediments because of the soft drink industry, became in 2014 the first city in the country to introduce a SSBs tax by imposing a 1 cent per ounce (a bit more than 11 cents for a 330ml can) what reduced sugary beverages consumption in 21% for low-income householders (Falbe et al., 2016). Another state which were in way of introducing a SSBs tax is Vermont, where the proposal was just the double than the Californian with a 2 cent per ounce tax (Drenkard, 2015).

On the other hand, in a country level, in the year 2010 it was introduced in US the Supplemental Nutrition Assistance Program, a food assistance program that was born with the aim of providing financial incentives to low income people. It was estimated (Ratcliffe et al., 2011) that almost 15% of householders in US were in danger because of food insecure in 2009, what motivated the government to interact by this subsidy measure. A study calculated that a reduction of 30% on some concrete fruit and vegetable price increased the consumption by 26% (US Department of Agriculture, 2016)

Denmark

In the case of Denmark, this country introduced a tax on saturated fat in 1 October 2011 with a duration of 2 years which demonstrated to reduce saturated fats' consumption and reduced the rate of mortality preventable from non-communicable diseases. This tax was introduced to foods which had more than 2.3 g/100 g of this kind of fat. It finally supposed a 2'15 €/Kg tax, in addition of the 25% VAT.

It is remarkable that the short duration of this measure was due to the need of a public health organization's support and the few public documentation of the positive effects, what made groups who were opposite to the project, such as the food industry and some organizations, emphasise the negative ones making bad publicity and starting a juridical processes against it (Smed et al., 2016; Smed, 2012; Holm, et al., 2013).

There is valuable concepts that can be learnt from this countries' experiences:

- Before introducing any kind of price policy it should be calculated how it will affect consumption behaviour and health of population through mathematical analysis and documentation of previous research.

- It would be useful to considerate the advices coming from health institutions taking in account that it will improve coordination between tax implementers and health professionals.
- Effects on long-term population's benefit must be studied and compared with the middle-term ones.
- The tax must be well designed and solid in order to be appropriate and to satisfying the citizens' needs

3.4 Some arguments against the tax

One of the principal arguments mentioned before is the fact that this tax will mainly affect low-income population, who have to use a bigger part of their rent if they would like to maintain their consumption. It can be partially solved by introducing subsidies on concrete healthy foods such as fruits and vegetables, because again, the effect is greater for them in a price modification.

A matter of contention among specialist of sugar is that substitutes for sugary drinks may not be as good as it is thought about. The entire tax system is based on the fact that substitute products are better than sugared ones, but some researches who have found evidences of some diet sodas which are no better for healthy weight than full sugar drinks (Brogan et al., 2017) or even that may favour the appearance of some non-communicable diseases such as diabetes (Nettleton et al., 2009) or Stroke and dementia (Pase et al., 2017). Having this into account maybe it would be necessary to tax not only sugared drinks (what has been proved to improve population's health by itself) but to introduce also a tax on unhealthy substitute beverages.

Another issue that occurs with a measure which depends only on the amount of sugar supposes a problem to generic brands. In the case of Catalonia it has caused the price increasing of around 10% on average in branded products, while in the case of the generic ones the increase shoots up to 50% or even more (Romero & Triana, 2017a). This reduction on the differential of the two groups may lead to a change on consumption that benefit the leading brands. Particularly in Catalonia there have appeared some conflicts because some companies and entities of the food sector oppose the tax arguing that it breaks the market unity, what obstruct difficult the free circulation of goods because of the rise of price of soft drinks in Catalonia compared to the product's price in the rest of the country, among other damages (Romero & Triana, 2017b).

4. The implementation of the tax in Catalonia

The Parliament of Catalonia approved in March, 2017, the law which created the tax on canned sugared drinks. This new tax has the main purpose is of encouraging a change in consumption habits, as recommended by the World Health Organization (Agencia tributaria). The measure seeks to penalize the consumption of drinkable products whose composition exceeds five grams of sugar per 100 millilitres, in line with the latest recommendations of the WHO. It has been observed (Barquero, 2017) that the increase in prices will be especially noticeable in white brand drinks of less value than the 'original', because, while the last ones will suffer a variation almost 20% the cheaper ones' prices can range up to 50%.

The Catalan tax establishes a type of levy that varies according to the sugar content in the drink what supposes that beverages with a sugar content between 5 and 8 grams per 100 millilitres are taxed by 0,08 €/l and the ones containing more than 8 grams per 100 millilitres of sugar are taxed by 0'12 €/l. The Catalan government has classified the sugar sweetened beverages classified in the following way:

TABLE 2: SSBs' classification of the Catalan's tax

Sugar sweetened beverages' classification
Soft drinks or sodas
Fruit nectar drinks and fruit juices
Sport drinks
Energy drinks
Sweetened milks, milkshakes and milk drinks with fruit juice
Vegetal drinks

Source: FIDE (2017)

From those, beverages made from natural fruit juices and vegetables, as well as milk or milk alternatives, which do not contain added calorific sweeteners, are exempt from the tax. This decision makes that the drinks that will be considered to be taxed are soft sodas, sport drinks and energy drinks. This will be the criterion followed to take the data that will be observed in this research.

5. The demand function's specification

Something to consider when addressing applied economic study is the proper way to create the demand functions that defines reality in the most correct terms. So, it must be taken into account if prices are fixed and quantities are endogenous or, just in the opposite case, if quantities are given and prices are the ones which are adjusted.

In this research it will be followed the thought that demand functions are the most efficient when quantity is dependent prices are exogenous, based in some studies which support this method (Deaton and Muellbauer, 1980; McLaren et al., 1995). In this case it can be due to the fact that there are just a few companies in the soft drinks' market, what distance it from the perfect competition and it can be considered for consumers that prices are exogenous.

Due to the fact that SSBs are beverages with a high dense energy, changing its consumption by any other type of drink, which are a healthier choice than SSBS, it will probably suppose the reduction of calories (DellaValle et al., 2005).

It has always been an important task for microeconomics in the study of distribution and welfare to observe through econometrics the household consumption. During the years there have been developed several models and ways to analyse the observations given what affects noticeably demand functions, because the transcendence of knowing how household behaves, especially in food consumption, is directly related to the level of well-being of the population.

In the literature on consumption there are distinguished three main currents:

On the one hand, there are studies that analyse the changes in consumption decisions and the expenditure to changes in income levels (Engel curve analysis, which are curves that relate the quantity consumed of a good and the rent) (Gibson, 2002). A second group (Pollak, 1981; Kokoski, 1986) has focused on the relationship between the level of household expense and the structure of households. In other words, how characteristics such as the size of the household or the sex and age of its members influence the allocation of their income and the types of goods that are consumed in home. In general, these studies incorporate variables such as the age of the head of the family, the level of education of the persons who bring home the money, the age of the members and obtain interesting results, concluding that both the demographic differences and the changes in preferences are relevant to explain household spending. But, the deeper it goes, the more complex may be founding data in the research of this kind of studies. In the last group they focus the analysis on the effect of price changes in

the consumer basket (the study of the price elasticity of demand). Through this method of researching it must be taken into account the income and substitute products among which consumers will be able to choose instead of sugary drinks (Deaton, 1986; Pindyck et al., 2009; Kumar et al., 2011). This research follows this last method.

6. Estimating the demand's elasticity for the Spanish case

6.1 Specification of the model

It will be here described the method of analysis used to calculate the elasticity of the demand by using the monthly data of 132 observations (from 01-2006 to 12-2016) of Spaniards' home consumption, and as it was mentioned in the previous section, focusing the study on the effect of price changes on the consumer basket. It is taken as variables which affect the consumption (Q_{SSBs}): the SSBs' price (P_{SSBs}), the price of substitute products (P_{NOSSBs}) and the income (Y). As a consequence of these considerations based in the ideas proposed by Kumar (2011) there will be used the following regression:

$$\ln(Q_{SSBs}) = \alpha + \gamma_1 \ln(P_{SSBs}) + \gamma_2 \ln(P_{NOSSBs}) + \beta \ln(Y) + \mu \quad (1)$$

Where:

Q_{SSBs} ->Amount of consumption for SSBs

P_{SSBs} ->Average price for SSBs

P_{NOSSBs} ->Average price for every alimentary good but SSBs

Y ->Part of income dedicated to food and drink consumption

μ ->Not considered Variables such as level of education or family size

6.2 Obtaining datum

It has been downloaded from Ministerio de agricultura y pesca, alimentación y medio ambiente (MAPAMA, 2017) the monthly data on sugary beverages and all the food and drink products, taking into account the total quantity consumed, quantity per capita, the total sales value and the average sales value.

In order to obtain a more accurate estimation of SSBs' demand (QSSBs) it will be taken into account per capita demand instead of the absolute demand because in the 11 years of the data (2006 to 2016) the population in Spain has increased from just over 44 million to 46.5, which may alter the data. For the average price of sweetened beverages and the rest of foodstuff (PSSBs and PnoSSBs), because the ministry does not provide data on the average price of the different food products, it will be taken the average value (Total Sales Value / Total quantity consumed) as an approximate variable. In the case of the rest of alimentary products the average price has been estimated dividing their average value by the amount consumed. The variable rent has been estimated as the total sales value of every food and drink per capita.

With the purpose of having the constant prices and so that our estimation is not affected by the inflation rate, the temporal series of variables P_{SSBs} , P_{noSSBs} , and Y has been deflated through the CPI that INE (2017) database provides using 2016 as base year. Therefore, it has been developed the specification of a regression where consumption depends on the average price of sugary drinks, the average price of the rest of alternative consumption and the income. Finally, it will be carried out a logarithmic transformation of the data, which will make easier to understand the parameters because an increment of a dependent variable in a $x\%$ suppose the rising of the dependent variable in $x \cdot \text{parameter}\%$.

The universe of the study has been all the homes in the peninsula, Balears and Canary Islands, excluding Ceuta and Melilla due to these are the Spanish territory from where the ministry offers the data. The sample of this research has change over the months of observation, because it has been varying from 6.000 in the first months to 12,000 in the year 2016. The observations were done by households pointing their purchases daily with an optical reader. The choice of this sample is random with a two-stage method. In the first stage the polling points were selected according to the size of the populations for each of the regions. In the second, the collaborators were selected at each of the chosen points.

The criterion of the tax installed in Catalonia has been followed to decide which drinks were considered sugary and which were not. In the Catalan case there have not been taxed the beverages made from fruit or vegetable juices, milks or drinkable yogurt. On the other hand there have been contemplated as SSBs soda waters, refreshing drinks, energy drinks and sports drinks.

6.3 Results

Finally, it has been applied Ordinary Least Squares on the data from where it has been obtained the following results:

TABLE 3: Results

Dependent Variable: $\ln(Q_{SSBs})$			
Independent Variables	Parameters	Standard Desviation	P-value
Constant	9,17	2,372	0,00018
$\ln(P_{SSBs})$	-1,32	0,402	0,00132
$\ln(P_{NOSSBs})$	1,79	0,657	0,00702
$\ln(Y)$	-2,08	0,639	0,00143

Estimated by OLS

Table 3 shows the results of this study where the three parameters of the regression. In every estimation, the fact that the p-value is so small makes the significance very high, and therefore, these parameters cannot be rejected as a true explanation of reality.

It can be observed here how the independent variables affect the quantity of sugary drinks' demand and, because of logarithmic transformation interpretations are even clearer. If P_{SSBs} gets bigger by an $x\%$ tax it will suppose a decrease by $1'32 \cdot x\%$ on the sugary drinks intake, in other words, elasticity of demand appears to be definitely elastic, what gets a decrease bigger than the tax that would be introduced. On the other hand, the positive parameter of variable P_{NOSSBs} means that, in order to reduce the amount of SSBs' consumption by interceding on this variable, it will be needed to subsidize it. In the case that the intention is to improve population's health only healthy food and drink will be subsidize.

We are finally faced with the parameter of the variable Y , which is negative. This means that families who have a lower income are the ones who consume the major quantity of sugar sweetened beverages, what can be understood as that when families have a higher income they change their consumption of these products by others, which definitely have a lower amount of sugar, so increasing income by itself would have benefits in this way.

6.4 Model's limitations

It has been used the average sales values as an approximation to the price variables because the ministry does not provide data on the original average prices, and because of this, one of the greatest limitations of this model is that the data only presents the home consumption instead of total consumption what would include alimentary purchase in restaurants, coffee shops or canteens.

The average price of all consumer goods has been introduced in the variable "PNOSSBs", so the different variations of each product are not collected in each observation. In addition, the income variable does not include the different asymmetries from which it could be concluded that there is a different consumption's behaviour in terms of income, which other authors have confirmed. Therefore, because these explanatory variables present an asymmetric distribution, there may be a loss of efficiency in these estimators. Ultimately, a more complete study would collect the effect of the price variation of all food and substitute beverages separately, and would consider, in addition, different effects but this requires a series of hours of data collection that go beyond what is reasonable for this work. It must take into account, therefore, that they are not totally adjusted to reality data, but a close study.

6.5 Discussion

Keeping in mind the limitations of the model mentioned, a few conclusions can be drawn. Great variations of the quantity due to of price movements (PSSBs and PNSSBs) justify both taxes and subsidies on these foods. If the increase of SSBs prices by the introduction of the tax reduces their consumption considerably this supposes an argument in favour of its implantation, because if the elasticity is so high it cannot have an economic motivation, because it will be much greater the effect on the reduction of consumption than the one on collection.

The fact that the elasticity of demand for this product is $\epsilon = -1.32$ means that in order to achieve a reduction in SSB consumption of over 20% to 50% (as proposed by sources such as the World Organization of Health), a tax that increases the price of sweetened beverages between 15% and 38% must be applied. But, why is this elasticity so high? In the case of excise duties on tobacco, one factor for smokers to not abandon the habit is that it cannot be find a product or an activity that satisfies the same "needs" as it. So it seems logical that the elasticity is much lower than that of products containing

sugar. Following the same argument, since there are "almost perfect" substitute goods for sugary drinks, such as other healthier drinks or even the same brand in the "no sugar" category, which would not be subject to this tax this measure will be definitively effective. It is expectable that in the face of rising prices, the possible decline of other, healthier foods and the awareness of the population that this substance is more harmful than we thought will make the measure more effective.

7. Conclusions

A specific tax on sugary drinks is feasible in Spain and could help other measures in progress, such as healthy eating programs in schools or the promotion of forms of distribution of local foods. Reducing the consumption of sugar-sweetened health benefits with the immediate effect and, because of the high appearance of the price elasticity, a specific tax that supposes, on average, greater than 15% of the price would reduce the weight many children and adults. As it has been proven, a higher price of SSB's is directly related to a diminution in this product's intake, and the higher is the increase, the greater will be the consumption reduction. Moreover, as soft drinks price's goes up, intake of fruit juices and milks, which are a healthier choice than SSBS, will be preferred, what will be improve calorie amount intake. Definitively, among the various types of taxes that can be found, taxes on the quantity of the specific product seem more suitable for tobacco, alcohol and sweetened drinks because it is not a matter of promoting the consumption of products of lower price but of reducing the quantities consumed. In addition, they are not manipulable by sellers, who could lower prices strategically and thus reduce the tax effectivity, so it falls directly to the manufacturer, which can stimulate innovation of less harmful products. As opposed to tobacco and alcohol the scientific evidence for sugary drinks is now emerging because the taxing experience is more recent. In all three cases, it seems advisable to make a combination of fiscal policies (both, taxes and subsidies) and public advertising policies which changed the image that these products have, by restricting advertising or labelling information to evidence the harmfulness of these products.

An alternative solution to the overconsumption of sugar may be the placement of a labelling colour system on the product packaging with easy information for consumers. These labels would express in simple terms the amount of fat, salt, sugar (or any substance that would be interesting to be under control) contained in the food or drink and by which it could easily be discerned whether the customer is interested or not. A

simple method (because it is simple by itself and population is already used to it) would be having a three colour plan using green for a low amount of the harmful substance, orange for a higher quantity and red for an unhealthy proportion of it, just like traffic lights. By this way consumers would not be having an extra cost (in the case of taxing), making sure that consumers do not affect their basket of goods, and at the same time would be punishing the most harmful food producing companies, when recognizing a "negative" label the consumer is expected to replace it with a similar one with better labelling, what would rewarding companies that had a healthier product on the market.

Finally, there are some lessons that can be learnt after get immersed in the topic of Sugar sweetened beverages' tax implementation, which are that:

- It is the duty of each government authorities to introduce fiscal policies and complementary measures which look for population welfare despite the opposition of the food and drink industries.
- As it has been observed obesity and the rest of non-communicable diseases have a complex origin, because its formation is due to multiple variables. Once taken this into account it is logic to suppose that it will be needed a not simple solution composed by different policies to overcome these diseases. It will be necessary to support the production of healthier food through economic measures, for example giving aids to this food's producers, and the public promotion of its consumption rather than just taxing unhealthy food.
- It is needed to go in depth in the topic of how food taxes modify the low rent population and children's behaviour, because these two groups will be the most affected, and deeper researches may search for further goals than just calculating demand's elasticity such as potential health gains of the children's life in the moment of the taxation or the reduction of costs that will have in the future the health sector.
- Taxation on products such as tobacco, alcohol and sweetened beverages seeks to eliminate the negative effects that their consumption imposes not only on the consumer but also on other citizens: the negative externalities derived from health care and social care collectively.

8. References:

Aaron, D. G., & Siegel, M. B. (2017). Sponsorship of national health organizations by two major soda companies. *American Journal of Preventive Medicine*, 52(1), 20-30.

Agencia tributaria de Cataluña (2017) El Parlamento ha aprobado el impuesto sobre las bebidas azucaradas envasadas. <https://atc.gencat.cat/es/agencia/noticies/detall-noticia/20170323-impot-begudes-ensucrades>

Amine, E., Baba, N., Belhadj, M., Deurenbery-Yap, M., Djazayery, A., Forrester, T., ... & Katan, M. (2002). Diet, nutrition and the prevention of chronic diseases: report of a Joint WHO/FAO Expert Consultation. World Health Organization.

Andreyeva, T., Long, M. W., & Brownell, K. D. (2010). The impact of food prices on consumption: a systematic review of research on the price elasticity of demand for food. *American journal of public health*, 100(2), 216-222.

Apovian, C. M. (2004). Sugar-sweetened soft drinks, obesity, and type 2 diabetes. *Jama*, 292(8), 978-979.

Appleton, N. (1985). Lick the sugar habit. Penguin.

Aranceta-Bartrina, J., Pérez-Rodrigo, C., Alberdi-Aresti, G., Ramos-Carrera, N., & Lázaro-Masedo, S. (2016). Prevalencia de obesidad general y obesidad abdominal en la población adulta española (25–64 años) 2014–2015: estudio ENPE. *Revista Española de Cardiología*, 69(6), 579-587.

Avena, N. M., Long, K. A., & Hoebel, B. G. (2005). Sugar-dependent rats show enhanced responding for sugar after abstinence: evidence of a sugar deprivation effect. *Physiology & behavior*, 84(3), 359-362.

Avena, N. M., Rada, P., & Hoebel, B. G. (2008). Evidence for sugar addiction: behavioral and neurochemical effects of intermittent, excessive sugar intake. *Neuroscience & Biobehavioral Reviews*, 32(1), 20-39.

Barquero, C.S. (2017) Las latas de refresco cuestan un 7% más desde hoy en Cataluña. El país http://ccaa.elpais.com/ccaa/2017/04/30/catalunya/1493549390_006271.html

Basu, S., Vellakkal, S., Agrawal, S., Stuckler, D., Popkin, B., & Ebrahim, S. (2014). Averting obesity and type 2 diabetes in India through sugar-sweetened beverage taxation: an economic-epidemiologic modeling study. *PLoS medicine*, 11(1), e1001582.

Beaglehole, R., Bonita, R., Horton, R., Adams, C., Alleyne, G., Asaria, P., ... & Cecchini, M. (2011). Priority actions for the non-communicable disease crisis. *The Lancet*, 377(9775), 1438-1447.

Boseley, S. (2003). Sugar industry threatens to scupper WHO. *The Guardian*, 21(4).

Bray, G. A., & Popkin, B. M. (2014). Dietary sugar and body weight: Have we reached a crisis in the epidemic of obesity and diabetes?. *Diabetes care*, 37(4), 950-956.

- Brogan, C. (2017). Sugar-free and 'diet' drinks no better for healthy weight than full sugar drinks. Imperial college London
http://www3.imperial.ac.uk/newsandeventspggrp/imperialcollege/newssummary/news_3-1-2017-16-59-3
- Brownell, K. D., Farley, T., Willett, W. C., Popkin, B. M., Chaloupka, F. J., Thompson, J. W., & Ludwig, D. S. (2009). The public health and economic benefits of taxing sugar-sweetened beverages.
- Cabrera-Escobar, M. A. C., Veerman, J. L., Tollman, S. M., Bertram, M. Y., & Hofman, K. J. (2013). Evidence that a tax on sugar sweetened beverages reduces the obesity rate: a meta-analysis. *BMC public health*, 13(1), 1072.
- Cahuana-Hurtado, L., Sosa-Rubi, S., Rubalcava-Penafiel, L., Panopoulou, P., & Rodriguez-Oliveros, G. (2013). Will the poor and high consumers benefit more by obesity prevention fiscal policies? Evidence from Mexico.
- Caprio, S. (2012). Calories from soft drinks—do they matter. *N Engl J Med*, 367(15), 1462-1463.
- Cawley, J. (2000). Body weight and women's labor market outcomes (No. w7841). National bureau of economic research.
- Cecchini, M., Sassi, F., Lauer, J. A., Lee, Y. Y., Guajardo-Barron, V., & Chisholm, D. (2010). Tackling of unhealthy diets, physical inactivity, and obesity: health effects and cost-effectiveness. *The Lancet*, 376(9754), 1775-1784.
- Center d'Études et de Documentation du Sucre <http://www.lesucre.com/actualite.html>
- Chan, M. (2013) WHO Director-General addresses health promotion conference
http://www.who.int/dg/speeches/2013/health_promotion_20130610/en/
- Chaput, J. P., & Tremblay, A. (2009). Obesity and physical inactivity: the relevance of reconsidering the notion of sedentariness. *Obesity facts*, 2(4), 249-254.
- Chriqui, J. F., Eidson, S. S., Bates, H., Kowalczyk, S., & Chaloupka, F. J. (2008). State sales tax rates for soft drinks and snacks sold through grocery stores and vending machines, 2007. *Journal of public health policy*, 29(2), 226-249.
- Colantuoni, C., Schwenker, J., McCarthy, J., Rada, P., Ladenheim, B., Cadet, J. L., ... & Hoebel, B. G. (2001). Excessive sugar intake alters binding to dopamine and mu-opioid receptors in the brain. *Neuroreport*, 12(16), 3549-3552.
- Colchero, M. A., Popkin, B. M., Rivera, J. A., & Ng, S. W. (2016). Beverage purchases from stores in Mexico under the excise tax on sugar sweetened beverages: observational study. *bmj*, 352, h6704
- De Ruyter, J. C., Olthof, M. R., Seidell, J. C., & Katan, M. B. (2012). A trial of sugar-free or sugar-sweetened drinks and body weight in children. *Janne de Ruyter*, 367, 71.
- Deaton, A. (1986). Demand analysis. *Handbook of econometrics*, 3, 1767-1839.
- Deaton, A., & Muellbauer, J. (1980). An almost ideal demand system. *The American economic review*, 70(3), 312-326.

DellaValle, D. M., Roe, L. S., & Rolls, B. J. (2005). Does the consumption of caloric and non-caloric beverages with a meal affect energy intake? *Appetite*, *44*(2), 187-193.

DeSalvo, K. B., Olson, R., & Casavale, K. O. (2016). Dietary guidelines for Americans. *Jama*, *315*(5), 457-458.

Drenkard, S. (2015). Vermont Soda Excise Tax Fizzles Out. *Forbes*
<https://www.forbes.com/sites/thetaxfoundation/2015/04/30/vermont-soda-excise-tax-fizzles-out/#19829f21520e>

Ernst, M., Heishman, S. J., Spurgeon, L., & London, E. D. (2001). Smoking history and nicotine effects on cognitive performance. *Neuropsychopharmacology*, *25*(3), 313-319.

Falbe, J., Rojas, N., Grummon, A. H., & Madsen, K. A. (2015). Higher retail prices of sugar-sweetened beverages 3 months after implementation of an excise tax in Berkeley, California. *American Journal of Public Health (ajph)*. Holt E: Hungary to introduce broad range of fat taxes. *Lancet* 2011, *378*(9793):755.

Falbe, J., Thompson, H. R., Becker, C. M., Rojas, N., McCulloch, C. E., & Madsen, K. A. (2016). Impact of the Berkeley excise tax on sugar-sweetened beverage consumption. *American journal of public health*, *106*(10), 1865-1871.

FIDE (2017) Establecimiento de un nuevo impuesto sobre bebidas azucaradas en Cataluña. http://www.fide.es/es/wp-Content/uploads/2017/03/Impuesto_sobre_Bebidas_azucaradas.pdf

Fletcher, J. M., Frisvold, D., & Tefft, N. (2010). Can soft drink taxes reduce population weight? *Contemporary Economic Policy*, *28*(1), 23-35.

Gibson, J. (2002). Why does the Engel method work? Food demand, economies of size and household survey methods. *Oxford Bulletin of Economics and Statistics*, *64*(4), 341-359.

Gortmaker, S. L., Wang, Y. C., Long, M. W., Giles, C. M., Ward, Z. J., Barrett, J. L., ... & Cradock, A. L. (2015). Three interventions that reduce childhood obesity are projected to save more than they cost to implement. *Health Affairs*, *34*(11), 1932-1939.

Hermann, L. & Moreira, P.; Perrin, E. & Renaud, J.B. (2012). *Sucre, comment l'industrie vous rend accros*. France.

Hoebel, B. G., Hernandez, L., Schwartz, D. H., Mark, G. P., & Hunter, G. A. (1989). Microdialysis Studies of Brain Norepinephrine, Serotonin, and Dopamine Release During Ingestive Behavior Theoretical and Clinical Implicationsa. *Annals of the New York Academy of Sciences*, *575*(1), 171-193.

Holm, A. L., Laursen, M. B., Koch, M., Jensen, J. D., & Diderichsen, F. (2013). The health benefits of selective taxation as an economic instrument in relation to IHD and nutrition-related cancers. *Public health nutrition*, *16*(12), 2124-2131.

Hu, F. B. (2013). Resolved: there is sufficient scientific evidence that decreasing sugar-sweetened beverage consumption will reduce the prevalence of obesity and obesity-related diseases. *Obesity reviews*, *14*(8), 606-619.

- INE (2017). Boletín Mensual de Estadística: Diciembre 2016
<http://www.ine.es/jaxi/Tabla.htm?path=/t38/p604/a2000/10/&file=1800005.px&L=0>
- James, W. P. T. (2008). WHO recognition of the global obesity epidemic. *International Journal of Obesity*, 32, S120-S126.
- Kokoski, M. F. (1986). An empirical analysis of intertemporal and demographic variations in consumer preferences. *American Journal of Agricultural Economics*, 68(4), 894-907.
- Krisberg, K. (2016). Study finds dozens of health, medical organizations take soda company money <http://scienceblogs.com/thepumphandle/2016/10/19/study-finds-dozens-of-health-medical-organizations-take-soda-company-money/>
- Kumar, P., Kumar, A., Parappurathu, S., & Raju, S. S. (2011). Estimation of demand elasticity for food commodities in India. *Agricultural Economics Research Review*, 24(1), 1-14.
- L Novak, N., & D Brownell, K. (2011). Taxation as prevention and as a treatment for obesity: the case of sugar-sweetened beverages. *Current pharmaceutical design*, 17(12), 1218-1222.
- Lehmann, W., & Bosche, L. (2003). *Lobbying in the European Union: Current rules and practices*. Luxembourg: European Parliament.
- Lim, S. S., Vos, T., Flaxman, A. D., Danaei, G., Shibuya, K., Adair-Rohani, H., ... & Aryee, M. (2013). A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *The lancet*, 380(9859), 2224-2260.
- Long M, Gortmaker S, Ward Y, Resch S, Moodie M, Sacks G, Swinburn B. Cost effectiveness of a sugarsweetened beverage excise tax in the US. *Am J Prev Med*. 2015; 49: 112-23.
- Ludwig, D. S., Peterson, K. E., & Gortmaker, S. L. (2001). Relation between consumption of sugar-sweetened drinks and childhood obesity: a prospective, observational analysis. *The Lancet*, 357(9255), 505-508.
- Lustig, R. H. (2010). Fructose: metabolic, hedonic, and societal parallels with ethanol. *Journal of the American Dietetic Association*, 110(9), 1307-1321.
- Lustig, R. H., Mulligan, K., Noworolski, S. M., Tai, V. W., Wen, M. J., Erkin-Cakmak, A., ... & Schwarz, J. M. (2016). Isocaloric fructose restriction and metabolic improvement in children with obesity and metabolic syndrome. *Obesity*, 24(2), 453-460.
- Malik, V. S., Pan, A., Willett, W. C., & Hu, F. B. (2013). Sugar-sweetened beverages and weight gain in children and adults: a systematic review and meta-analysis. *The American journal of clinical nutrition*, 98(4), 1084-1102.
- Malik, V. S., Popkin, B. M., Bray, G. A., Després, J. P., Willett, W. C., & Hu, F. B. (2010). Sugar-sweetened beverages and risk of metabolic syndrome and type 2 diabetes. *Diabetes care*, 33(11), 2477-2483.

- MAPAMA (2017). Últimos datos de consumo alimentario.
<http://www.mapama.gob.es/es/alimentacion/temas/consumo-y-comercializacion-y-distribucion-alimentaria/panel-de-consumo-alimentario/ultimos-datos/>
- McLaren, K. R., Fry, J. M., & Fry, T. R. (1995). A simple nested test of the almost ideal demand system. *Empirical economics*, 20(1), 149-161
- Murray, C. J., & Lopez, A. D. (1997). Global mortality, disability, and the contribution of risk factors: Global Burden of Disease Study. *The lancet*, 349(9063), 1436-1442.
- Nelson JE, Pearson HW, Sayers M, Glynn TJ, editors. (1982). Guide to Drug Abuse Research Terminology. National Institute on Drug Abuse; Rockville: 1982
- Nettleton, J. A., Lutsey, P. L., Wang, Y., Lima, J. A., Michos, E. D., & Jacobs, D. R. (2009). Diet soda intake and risk of incident metabolic syndrome and type 2 diabetes in the Multi-Ethnic Study of Atherosclerosis (MESA). *Diabetes care*, 32(4), 688-694.
- Ng, M., Fleming, T., Robinson, M., Thomson, B., Graetz, N., Margono, C., ... & Abraham, J. P. (2014). Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. *The lancet*, 384(9945), 766-781.
- Ng, S. W., Mhurchu, C. N., Jebb, S. A., & Popkin, B. M. (2012). Patterns and trends of beverage consumption among children and adults in Great Britain, 1986–2009. *British Journal of Nutrition*, 108(3), 536-551.
- Paraje, G. (2016). The effect of price and socio-economic level on the consumption of sugar-sweetened beverages (SSB): The case of Ecuador. *PloS one*, 11(3), e0152260.
- Pase, M. P., Himali, J. J., Beiser, A. S., Aparicio, H. J., Satizabal, C. L., Vasani, R. S., ... & Jacques, P. F. (2017). Sugar-and Artificially Sweetened Beverages and the Risks of Incident Stroke and Dementia. *Stroke*, STROKEAHA-116.
- Pindyck, R. S., Rubinfeld, D. L., Farnham, P. G., Miles, D., Scott, A., & Breedon, F. (2009). *Microeconomics*, 7th. Edition, 795-803.
- Pollak, R. A., & Wales, T. J. (1981). Demographic variables in demand analysis. *Econometrica: Journal of the Econometric Society*, 1533-1551.
- Pomeranz, J. L. (2012). Advanced policy options to regulate sugar-sweetened beverages to support public health. *Journal of public health policy*, 33(1), 75-88.
- Powell, L. M., Chiqui, J., & Chaloupka, F. J. (2009). Associations between state-level soda taxes and adolescent body mass index. *Journal of adolescent health*, 45(3), S57-S63.
- Prentice, A. M. (2006). The emerging epidemic of obesity in developing countries. *International journal of epidemiology*, 35(1), 93-99.
- Ratcliffe, C., McKernan, S. M., & Zhang, S. (2011). How much does the Supplemental Nutrition Assistance Program reduce food insecurity?. *American journal of agricultural economics*, 93(4), 1082-1098.

Romero, J. & Triana, C. (2017a). El impuesto catalán a los refrescos amenaza a las marcas blancas. *Eleconomista*<http://www.eleconomista.es/empresas-finanzas/noticias/8438873/06/17/El-impuesto-catalan-a-los-refrescos-amenaza-a-las-marcas-blancas.html>

Romero, J. & Triana, C. (2017b). El sector alimentario se revuelve contra la tasa al azúcar de Cataluña.

Eleconomista<http://www.eleconomista.es/nutricion/noticias/8428165/06/17/Todo-el-sector-alimentario-se-posiciona-contr-la-tasa-al-azucar-de-Puigdemont.html>

Sarlio-Lähteenkorva, S., & Manninen, M. (2010). School meals and nutrition education in Finland. *Nutrition bulletin*, 35(2), 172-174.

Sarlio-Lähteenkorva, S., & Manninen, M. (2010). School meals and nutrition education in Finland. *Nutrition bulletin*, 35(2), 172-174.

Smed, S. (2012). Financial penalties on foods: the fat tax in Denmark. *Nutrition Bulletin*, 37(2), 142-147.

Smed, S., Scarborough, P., Rayner, M., & Jensen, J. D. (2016). The effects of the Danish saturated fat tax on food and nutrient intake and modelled health outcomes: an econometric and comparative risk assessment evaluation. *European journal of clinical nutrition*.

Smith, T. A., Lin, B. H., & Lee, J. Y. (2010). Taxing caloric sweetened beverages: potential effects on beverage consumption, calorie intake, and obesity.

Swinburn, B. A., Sacks, G., Hall, K. D., McPherson, K., Finegood, D. T., Moodie, M. L., & Gortmaker, S. L. (2011). The global obesity pandemic: shaped by global drivers and local environments. *The Lancet*, 378(9793), 804-814.

Trujillo-Hernández, B., Vásquez, C., Almanza-Silva, J. R., Jaramillo-Virgen, M. E., Mellin-Landa, T. E., Valle-Figueroa, O. B.,... & Newton-Sánchez, O. (2010). Frecuencia y factores de riesgo asociados a sobrepeso y obesidad en universitarios de Colima, México. *Revista de salud pública*, 12(2), 197-207.

United States Department of Agriculture, Food and Nutrition Service, Office of Research and Analysis. (2016). Healthy Incentives Pilot (HIP) Final Report. Alexandria, VA; July 2013 (www.fns.usda.gov/sites/default/files/HIP-Final.pdf, accessed 3 April 2016)

Vélez, M. I. Á., & Jääskeläinen, F. D. M. (2014). Los lobbies en el marco de la unión europea: una reflexión a propósito desregulación en España. *Teoría y realidad constitucional*, (33), 353.

Willett, W. C., & Ludwig, D. S. (2013). Science souring on sugar. *BMJ*, 346(jan15 3), e8077-e8077.

World Health Organization. (2005). Preventing chronic diseases: a vital investment. World Health Organization.

World Health Organization. (2009). History of the World Health Organization framework convention on tobacco control.

World Health Organization. (2015a). *Using price policies to promote healthier diets*. WHO Regional Office for Europe.

World Health Organization. (2015b). Global action plan for the prevention and control of non-communicable diseases 2013–2020. 2013. Geneva: World Health Organization.

World Health Organization. (2016) Urges global action to curtail consumption and health impacts of sugary drinks.
<http://www.who.int/mediacentre/news/releases/2016/curtail-sugary-drinks/en/>

World Health Organization. (2016). Fiscal policies for diet and prevention of noncommunicable diseases: technical meeting report, 5-6 May 2015, Geneva, Switzerland.

World Health Organization. (2016). Global action plan for the prevention and control of noncommunicable diseases 2013–2020. Geneva: WHO; 2013.