

University of Florida

Food and Resource Economics: Undergraduate Honors Thesis

How the invention of high fructose corn syrup impacted society and society's attempt through taxes to curb consumption.

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April 6, 2018

Abstract

This study examines the theory that sugar trade quotas led to higher sugar prices resulting in the development of high fructose syrup and the food manufacturers' use of it in place of sugar as a cheaper input. In theory, this leads to cheaper food prices and higher quantity demanded for sweetened foods. The data show that this was true for some time, but in the late 1990s the price of high fructose corn syrup started to increase while the consumption dropped. The popularity of this theory and the heightened concern for the societal effects of obesity and other diet related diseases has led some local governments to impose taxes on sugar sweetened beverages. This study examines a few of these taxes, discusses how they may be able to become more effective, and discusses a few of their drawbacks.

Table of Contents

Introduction	4
Literature Review	6
Methods and Materials	10
Methods and Assumptions.....	10
Sugar Trade Quotas and Sugar Prices	10
Negative Externalities of Consumption	13
Data	15
Results and Discussion	15
Consumption and price analysis.....	15
Externality and taxation analysis.....	18
Recommendations and Conclusion	21
References	23

Introduction

Sugar has been a staple in the human diet for centuries. Before humans added sugar derived from sugar cane and sugar beets to their food, they sought out sweet foods such as fruit and honey (White, 2008). Through time there have been substitutes for sugar placed on the market to offer either healthier or cheaper alternatives. One such substitute is high fructose corn syrup which was invented in the 1960s and quickly replaced liquid sugar in the decades following (Casey, 1976).

Corn syrup is the forefather of high fructose corn syrup, but it was not an attractive alternative to sugar because it did not offer the same sweetness level. By concentrating the amount of fructose in corn syrup its composition and sweetness was comparable to that of liquid sugar (ibid). At the dawn of its invention high fructose corn syrup offered many benefits over traditional liquid sugar. For example, high fructose corn syrup offers the stability in acidic environments that liquid sugar lacks (White, 2008). Another attractive characteristic is its price. Many claim that there is an economic incentive for food manufacturers to choose the corn-derived product in place of traditional sugar (Casey, 1976; White, 2008).

Despite the stability and price advantages, there is an ongoing debate as to whether high fructose corn syrup is more harmful than sugar to human health. One study found that high fructose corn syrup differs from beet and cane sugar in ways that may lead to obesity. These differences lie in the molecular structures of these substances, causing their sweetness levels to differ (Bray, Nielsen, & Popkin, 2004). The sweetness level of a substance affects how human hormones react to the substances. High fructose corn syrup is sweeter than sugar which leads to the release of hormones known to cause obesity (Bray et al., 2004). Due to its popularity, there have been studies conducted to test the validity of the Bray study. One study conducted by White

examined five assumptions that must hold true in order for Bray's conclusion to be accepted. These assumptions include that high fructose corn syrup and sucrose must be significantly different, high fructose corn syrup must be uniquely obesity-promoting, high fructose corn syrup must be predictive of US obesity, high fructose corn syrup must be predictive of global obesity, and eliminating high fructose corn syrup from the food supply must significantly reduce obesity. White argues and explains that these assumptions do not hold true (White, 2008). Also in opposition to the Bray study is the corn refiners' association who note that sugar and high fructose corn syrup have the same sweetness levels (Corn Refiners Association, 2018).

Despite differing assumptions, both substances are said to lead to obesity when consumed in excess (Hall, 2018). Obesity is a concern for how it affects one's health, but it also poses economic challenges. Estimates indicated that in 2014 \$149.9 billion was spent by obese individuals on medical care, and individually obese medical patients spent on average \$1,901 (Kim & Basu, 2016). Not only is there concern about the obese individuals' medical expenses, but there is also concern about the externalities of obesity and diet related diseases. To combat these externalities some jurisdictions have decided to enact "sugar taxes" or "soda taxes". These are taxes on beverages that have a sugar or sweetener content.

There is no question that obesity and other diet related diseases such as type two diabetes are concerning. To help resolve these issues there has been input from the legislative and public sectors as to what to do, what not to eat, and how to live in order to not be effected by these diet related diseases. High fructose corn syrup has been a substance victimized by the media as an obesity and type two diabetes causing substance. Whether it does cause these diseases more so than sugar does is not the concern of this paper.

This paper addresses the popular theory that the invention of high fructose corn syrup led food manufacturers to use it in place of sugar resulting in more sweetened food and drink products introduced on the market. Also addressed is the current trend of “sugar taxes” or “soda taxes” that have been implemented to correct the negative externalities of consumption introduced by diet related diseases. Their implications on society will be discussed, compared, and evaluated.

Literature Review

There has been significant research on sugar and high fructose corn syrup. This literature review will address existing research focused on the context of this paper’s theme.

In his paper “Did the Food Environment Cause the Obesity Epidemic?”, Hall (2018) argues that the epidemic is not the result of an increase in just one macronutrient, rather it is due to an overall change to the environment in which food is manufactured, bought, prepared, and consumed. There is an increase in highly processed foods made from cheap agricultural commodities having properties that promote appetite and increase consumption. Hall argues that this coupled with the demand for fast and convenient meals or snacks is the source of the obesity epidemic (Hall, 2018).

While Hall’s focus is on what causes obesity and other diet related diseases, it is also important to understand why these diseases are of such a concern to society. Notwithstanding individual health concerns, Drewnowski (2004) argues that obesity is an important economic issue. He states that the highest U.S. obesity rates occur in places with the lowest incomes and least amount of education. He argues that diets based on refined grains, added sugars, and added fats are more affordable than diets based on lean meats, fresh vegetables, and fruit. These

statements led him to conclude that the biggest barrier to diet change in obese Americans may simply be budget (Drewnowski, 2004).

The theory that is of most concern in this paper became popular in 2003 when Greg Critser published a book entitled *Fat Land* in which he explains his theory that the prevalence of high fructose corn syrup in the modern American diet is due to high sugar prices and low corn and high fructose corn syrup prices (Critser, 2003).

Even before Critser published his book, concerns about the U.S. sugar quota program and how it affects the American food supply and economy were being circulated. In 1994 Noel Uri and Roy Boyd analyzed what would happen if the sugar quotas were eliminated. They concluded that such an elimination would reduce output for all producing sectors by about \$2.85 billion and \$2.95 billion for sectors outside of the agriculture industry. They found that there would be an increase of about \$197 million in consumption of goods and services and about \$121 million increase in welfare. Without the quotas, the government would lose about \$15 million (Uri & Boyd, 1994)

In 2015, a similar study was done by Beghin and Elobeid. They found that if the U.S. sugar program were to be removed consumer welfare would increase between \$2.9 and \$3.5 billion each year with an increase in sugar imports of about 5-6 million tons, all with minimal world sugar price increases. Their welfare findings are much higher than that of Uri and Boyd's because they only examined consumer welfare which would increase whereas Uri and Boyd (Uri & Boyd) looked at total welfare which takes into account the loss of welfare experienced by the domestic sugar producers. Beghin and Elobeid also found that there would be between 17,000 and 20,000 jobs created in the food manufacturing and similar industries with the removal of the U.S. sugar program (Beghin & Elobeid, 2015).

Another obesity and diet related disease economic issue is that of negative externalities of health care consumption. According to Cawley and Meyerhoefer, in 2005 88.2% of medical costs attributed to obesity were paid by health insurance companies, Medicare, and Medicaid. Due to how health insurance works this means that most costs associated with obesity are ultimately paid by non-obese policy holders (Cawley, 2015). In an effort to correct these negative externalities, various towns, cities, and jurisdiction have imposed taxes on sugar, high fructose corn syrup, or other sugar substitute sweetened products. These taxes have been faced with both praise and opposition.

Dr. Lisa Powell and her co-authors, supporting such taxes, examined the price elasticities of demand for sugar sweetened beverages, fast food, fruits, and vegetables and the association between price changes of these foods and body weight changes. They found that soda taxes had minimal impact on weight, but noted that this might have been because the taxes were low. They also found that higher fast food prices are associated with lower weight outcomes for adolescents and lower fruit and vegetable prices were also generally associated with lower weight outcomes. They conclude that taxes on unhealthy food, and subsidies for healthy food should be considered as policy options to mitigate public health risks (Powell, Chriqui, Khan, Wada, & Chaloupka, 2013).

In examining what they call “health taxes”, Alexandra Wright, Katherine Smith, and Mark Hellowell argue that these taxes reduce demand of unhealthy food. They use the term health taxes because they grouped taxes on all unhealthy goods such as alcohol, tobacco, and sweeteners together. In their systematic review, they examined 91 peer reviewed and 11 grey literature empirical studies of health taxes. They found that high tax rates on sugar sweetened beverages tend to have a positive impact on health outcomes and add to government revenue

(Wright, Smith, & Hellowell, 2017). In their paper, they briefly outline some of the concerns circulating about such taxes.

As such taxes have been levied in the United States, studies have been conducted to evaluate their effectiveness. In 2015, Berkeley, California implemented the nation's first large sugar sweetened beverage tax of 1 cent per ounce. Researchers examined its effectiveness. They found that prices on taxed items increased in many but not all stores, sales of taxed items declined, sale of untaxed substitutes rose, and overall consumer spending did not rise. They attributed the pattern of these changes to the tax (Silver et al., 2017). A similar study was conducted on the 1.5 cent per ounce Philadelphia soda tax by the research firm Catalina. Their main and highly publicized finding was that although sugar sweetened beverage sales saw a decline within the city limits where the tax was levied, soda sales increased outside of the city. (Catalina, 2017).

From studies that assert that high fructose corn syrup is a factor leading to obesity such as the Bray, Nielsen, and Popkin (2004) study, to those that state it is simply due to our current way of life as Hall (2018) claims, in the literature there are differing opinions on the effects of sugar and high fructose corn syrup on the human body. In this paper, the concern is not on how the two substances differ in their effects on human health, but rather how they affect the economy. There has been concerns about sugar trade quotas and whether they are beneficial to our economy (Drewnowski, 2004). This led Uri and Boyd along with Beghin and Elobeid to conduct their studies. In addition to these concerns, statements have been made and repeated that high sugar prices are due to sugar quotas, which have led to the use of high fructose corn syrup as a substitute for sugar. This in turn has led to lower food prices, and higher quantities of sweetened foods (Critser, 2003). These low prices and high quantities have been combated with taxes.

Existing research on these taxes demonstrate that they have had an overall positive impact on health outcomes. However, there are still some concerns about their effectiveness.

Methods and Materials

Throughout this paper different economic concepts and data sources will be used. Below is a description of these economic concepts and a listing of the data sources used.

Methods and Assumptions

Using the following datasets and the graphing function in Excel this paper will graph sugar and high fructose corn syrup prices and consumption against one another. Using economic theory, both changes in price and consumption of these two substances will be evaluated with the assumption that food manufacturers always strive to maximize profits. This will allow the researcher to assess their presence in the sweetened foods market over time.

This paper will also look at similarities and differences in laws and ordinances that have been passed to correct market failure related to sugar and high fructose corn syrup.

Sugar trade quotas and sugar prices

To help explain Critser's theory that states the level of high fructose corn syrup on the market is due to cheap corn prices and high sugar prices, an understanding of sugar trade policy is necessary (Critser, 2003).

Despite popular belief, sugar has never been subsidized by the federal government, but as an industry has been able to maintain higher domestic prices compared to those on the world market, through the implementation of tariff rate quotas (TRFs). Sugar quotas have been in place almost completely without interruption since the first Sugar Act of 1934 (Wiltgen, 2007). Figure 1 shows US sugar prices compared to the world price since the 1960s.

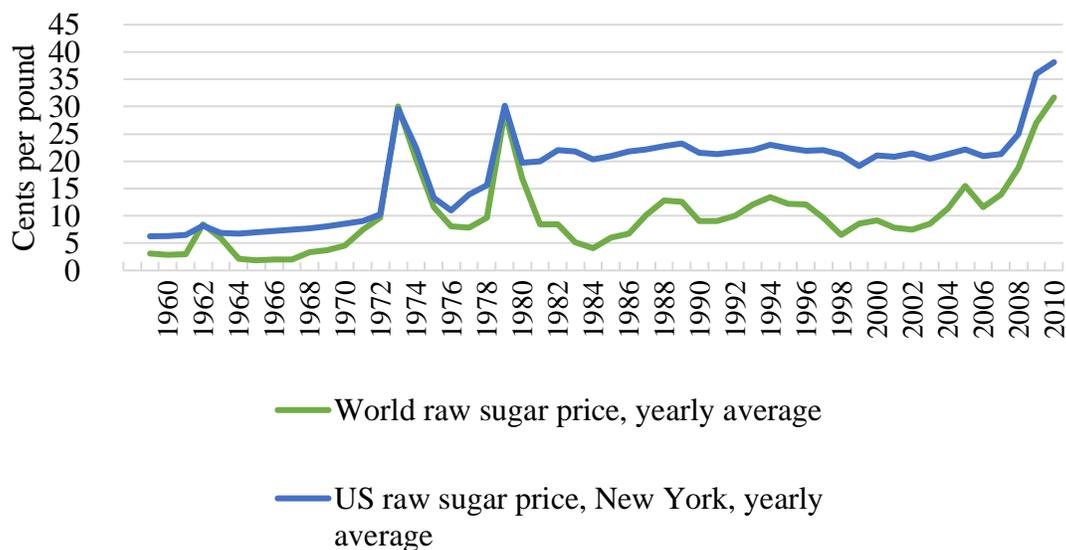


Figure 1 : World vs. UR Raw Sugar Prices

Data sources: USDA ERS Table 3b- World raw sugar price, USDA ERS Table 4- U.S. raw sugar price

TRFs allow for a specific quantity of a good to be imported each year with minimal duty, but imports are capped at that quantity (Schmitz, Moss, Schmitz, Furtan, & H, 2010). Figure 2 depicts the graph of a tariff rate quota. In figure 2, Q_S is the quantity supplied domestically with free trade, Q_D is the quantity demanded with free trade, the difference between Q_S and Q_D is the import amount with free trade, P_W is the world price, Q_S' is the quantity supplied domestically with a TRQ, Q_D' is the quantity demanded with a TRQ, the difference between Q_D' and Q_S' is the import amount with a TRQ, and P' is the price due to the TRQ. Figure 2 ultimately shows that with a TRQ domestic prices are pushed above the world prices, thus benefitting domestic producers.

Because sugar and high fructose corn syrup are substitutes to some extent, if these sugar quotas have kept sugar prices above that of high fructose corn syrup since its invention and market introduction in the late 1960s (Casey, 1976), then food manufacturers would have an incentive to use high fructose corn syrup in place of at least some sugar, as the goal of any business is to maximize profits.

Apart from the quotas there are other factors that affect the price of sugar and high fructose corn syrup such as advances in technology and shifts in high fructose corn syrup's main input, corn. Nevertheless, if high fructose corn syrup is cheaper over time and food manufacturers are incentivized to use, at least in part, the cheaper input of high fructose corn syrup then the supply curve in the market for sweetened foods would shift to the right, which leads to a higher quantity of food demanded, and lower sweetened food prices.

Figure 3 shows these effects. The shift of the supply curve to the right may be due to several reasons which include the use of cheaper inputs like high fructose corn syrup as well as changes in the prices of

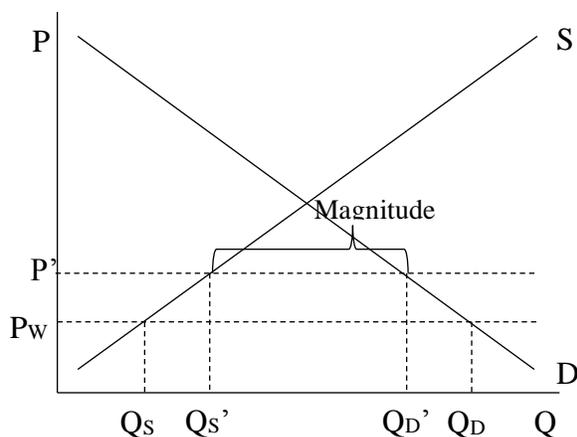


Figure 2 : Effect of TRQ on Importer

Adapted from Schmitz et al. 2010

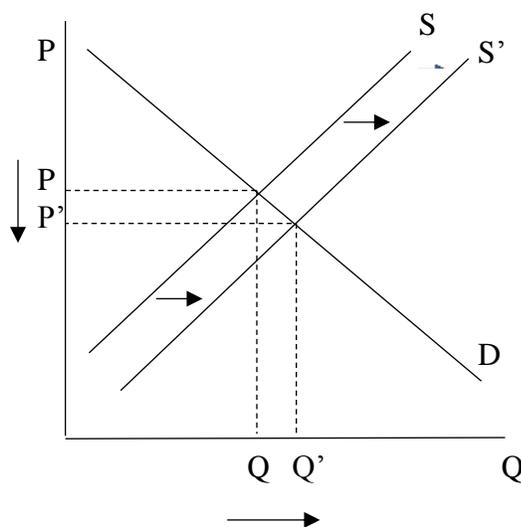


Figure 3 : Market for Sugar Sweetened Foods

inputs and changes in technology.

These are the economic theories that were used to justify the claim that Critser makes in his book. With high sugar prices due to the quotas, there was an incentive in the market to produce less expensive alternatives. The invention of high fructose corn syrup offered that cheaper alternative to sugar, thus food manufacturers were able to increase output and decrease their price compared to that prior to the invention of high fructose corn syrup.

To evaluate if this has indeed been the case, this paper will compare both price and consumption trends of sugar and high fructose corn syrup. If there has been a declining trend in high fructose corn syrup prices, then food manufacturers would have reason to decrease their use of sugar and increased their use of high fructose corn syrup. If this happened, then eventually consumption of sugar would be less than that of high fructose corn syrup and the market for sweetened food and beverages would see the effect in figure 3.

Negative externalities of consumption

Because it is believed that high sugar and low corn prices have led to an increase in consumption of sweetened foods and drinks there has recently been multiple cases of municipalities imposing taxes on sweetened beverages. One reason for imposing these taxes is to attempt to correct the market failure that higher consumption of sugar and its substitutes are said to cause. In the case of sugar and high fructose corn syrup, resultant obesity and its associated medical costs creates spillover costs on healthy individuals.

As mentioned in the literature review, Cawley and Meyerhoefer (2015) found that in 2005, 88.2% of medical costs attributed to obesity were paid by health insurance companies, Medicare, and Medicaid, thus most costs associated with obesity are ultimately paid by non-

obese policy holders (Cawley, 2015). The non-obese policy holders and tax payers are the third party paying the spillover cost of the negative externality; this is depicted in figure 4.

In figure 4, MPC is the marginal private cost, MSC is the marginal social cost, MPB is marginal private benefits, MSB is marginal social benefits, Q_e is the free market allocation, Q_s is the socially efficient allocation, and DWL stands for dead weight loss which is also the spillover cost. The difference

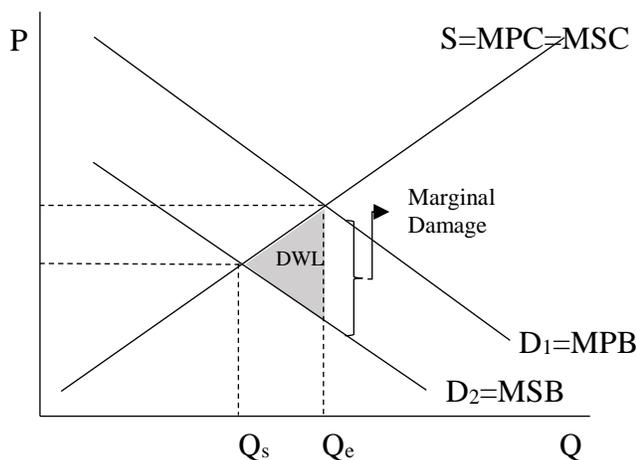


Figure 4 : Negative Externality of Consumption for Medical Care of those with Diet Related Diseases

Adapted from Gruber, J. (2010)

between marginal private benefit

(MPB) and marginal social benefits

(MSB) is the marginal damage done to those who do not consume medical care due to diet

related diseases (Gruber, 2010). As figure 4 shows, with diseases said to be caused by consuming

too much sugar or high fructose corn syrup such as obesity, the marginal private benefit

outweighs marginal social benefits leading to a negative externality of consumption.

The idea behind the sugar or soda taxes is to correct this market failure by implementing a tax in the amount of the marginal damage of each unit of consumption. In figure 5, P_e is the free market price, P_s is the socially efficient price and the price

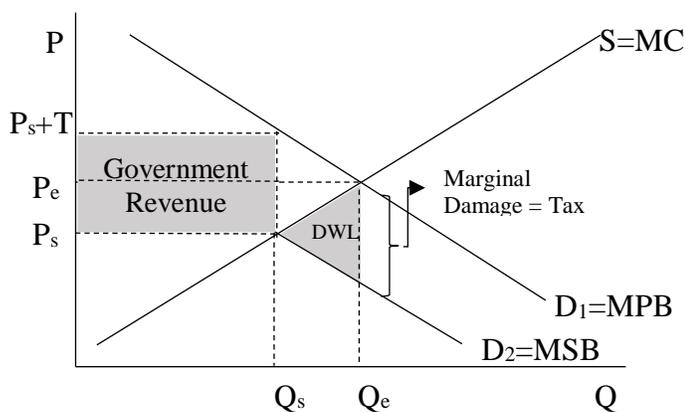


Figure 5 : Negative Externality Corrected with a Tax

received by producers, P_s+T is the price paid by consumers.

By looking at studies done on taxes that have been levied in Berkeley, California and Philadelphia, Pennsylvania and the legislation that put these laws in place successes and drawbacks of the laws will be discussed. The goal is to identify components of each law that have done well and others that can be improved upon in an effort to offer a more effective version of the tax.

Data

Apart from the economic theories and models discussed above, this research also involves the use of data collected from the United States Department of Agriculture Economic Research Service's Sugar and Sweeteners Yearbook tables. The datasets used include world raw sugar prices (Table 3b), US raw sugar prices (Table 4), US high fructose corn syrup prices (Table 9), US refined cane and beet sugar consumption (Table 51), and US high fructose consumption (Table 52).

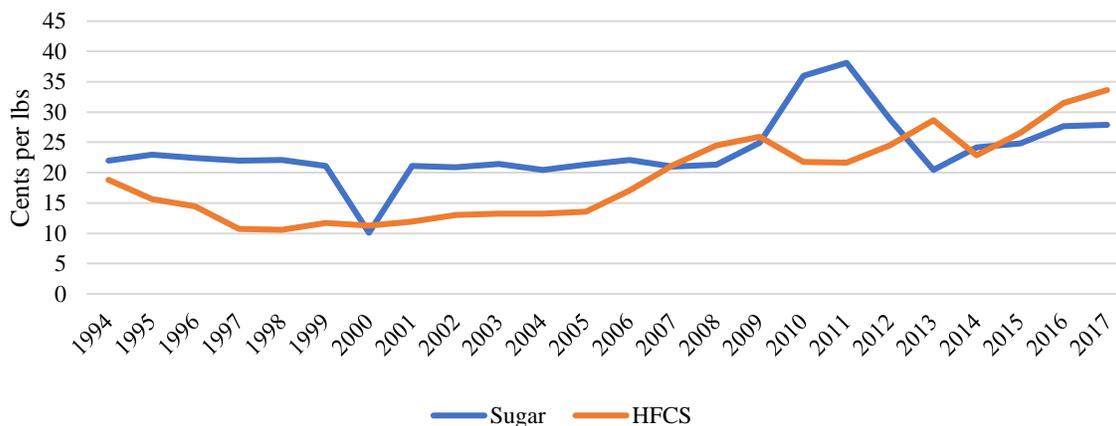
Results and Discussion

Consumption and price analysis

To test the popular theory that there is more sweetened food on the market today due to lower production costs, which are in part due to manufacturers substituting less expensive high fructose corn syrup in place of sugar, the trends in price and consumption of these substances must be compared.

First the differences in price will be evaluated. Below, figure 6 shows the prices of both sugar and high fructose corn syrup from 1994 to present; the graph does not reach farther back

because the available price data for high fructose corn syrup started in 1994 although price data for sugar reached much further back.



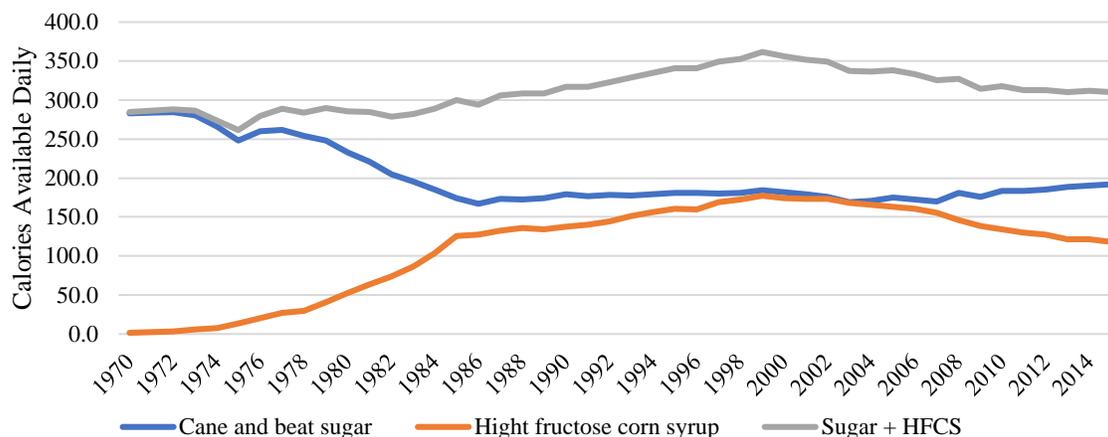
Sources: USDA ERS Table 4- US raw sugar prices, USDA ERS Table 9- US price for high fructose corn syrup

Figure 6 : Sugar vs HFCS Prices

Although consumption also needs to be evaluated to either confirm or deny Crister's theory, here we are looking at just the differences in price. For the theory to hold, high fructose corn syrup prices must be decreasing. Historically, this seems to have only held up until the mid 1990s. Figure 6 shows that since 1997 high fructose corn syrup prices have trended upwards which would mean that since this point the rightward shift of the supply curve depicted in figure 3 would not have occurred. From this data, it seems that since 1997 the price side of the theory has not held, but to fully evaluate the theory proposed by Critser, consumption levels also need to be looked at.

Since the price of high fructose corn syrup trended downward until 1997, it would make sense for manufacturers to continually decrease their use of sugar and increase their use of high

fructose corn syrup in their products up until the price started trending upward. Looking at the data, it seems that this was the case.



Sources: USDA ERS Table 51- Refined cane and beet sugar, USDA ERS Table 52- High fructose corn syrup

Figure 7 : Sugar and HFCS Consumption

In figure7, which shows the average number of calories consumed per person on a yearly basis, high fructose corn syrup consumption levels never quite beat out sugar. Although there was a difference of less than 10 calories between the two consumption levels between the years of 1998 and 2004, sugar has remained more prevalent in the food supply than high fructose corn syrup.

From looking at both price and consumption data, Critser's theory that sugar prices, inflated by sugar policy coupled with the invention of cheaper high fructose corn syrup led to a prevalence of cheap sweetened food on the market may have been true up until the mid 1990s. Six years before his book was published though these trends moved in the opposite directions. The increase in price and decline in high fructose corn syrup consumption may have been a response to health reporting, then later his book, and others who published similar theories. This

was also around the time when studies such as that published by Bray, Nielsen, and Popkin (2004) were publicized and many became wary of what high fructose corn syrup would do to one's health.

It is also important to note that the data shows a decline in combined consumption of sugar and high fructose corn syrup as can be seen by the gray line in figure 7. This too may be due to the recent negative press that all caloric sweeteners have gotten in the past decade. Their combined decline may also be due to an increased presence of non-caloric sweeteners such as those derived from saccharine, aspartame, and stevia being introduced to the market. Despite their combined decreased consumption, obesity and diet related diseases are still an issue many are trying to solve.

Externality and taxation analysis

As discussed, the presence of obesity and other diet related diseases lead to market failure in the form of negative externalities of consumption. One way to correct such market failure is to implement a tax as previously shown in figure 4. As discussed in the literature review there have been multiple cases of taxes imposed in the US to help curb some of these negative externalities. Here these case studies will be discussed more fully in an effort to continue the discussion so that policy can continue to evolve in a beneficial way.

In Berkeley, tax was put in place to “diminish the human and economic costs of diseases associated with the consumption of sugar drinks” (New Berkeley Municipal Code Chapter 7.72: Sugar-Sweetened Beverage Product Distribution Tax, 2015). To accomplish this goal, distributors of sugary drinks will be taxed one cent per ounce until January 1, 2027. Similarly, in Philadelphia, a tax of one and a half cents per ounce is to be charged to dealers of sugar sweetened beverages starting January 1, 2017 (Chapter 19-4100 of the Philadelphia Code).

Sugar-Sweetened Beverage Tax, 2016). Although such taxes have been shown to limit the consumption of sugary drinks as shown in studies like that conducted by Silver et al. (2017), the current taxes proposed by both jurisdictions lead to a few issues.

For a tax to completely correct the market failure, it must equal the marginal damage of each unit being consumed, in the case of Berkeley that would be each ounce and in Philadelphia each ounce and a half. Determining such a value requires a knowledge of the external cost of consuming each unit which was not mentioned as a factor in coming up with the one cent or one and a half cent taxes levied in Berkeley and Philadelphia respectfully. Figuring out what the amount of a tax that will completely correct the market failure may be difficult, but doing would be ideal. If the tax is equal to the marginal damage and the municipalities use the tax revenue to pay for the medical costs associated with diet related diseases, then the socially optimal price and quantity would be reached. This would also mean that by paying the tax when purchasing sugary drinks and snacks those with the diet related diseases seeking medical care would be paying their own medical costs.

Another issue regarding the amount of the tax, is that both laws call for a steady tax through time. In Berkeley, the tax is to continue at one cent per ounce until January 1, 2027 and in Philadelphia the law only states an effective date not a termination date. Although these laws can be amended, the way they are currently written they do not take inflation into account meaning that as time passes the taxes will become less and less effective as inflation increases over time.

Although the Berkeley and the Philadelphia tax are both still in place, there have been cases of similar taxes failing in location such as Cook County, Illinois (Powell & Maciejewski, 2018). The main difference between the taxes that are still in place and those that have been

repealed is where the tax revenue has gone. In areas like Berkeley and Philadelphia the tax revenue has been used to fund specific educational and health related projects, which Powell and Maciejewski (2018) speculate is why their laws have not been repealed like Cook County's where it was never entirely clear where the tax revenue went. Although this is not directly related to how effective the law is, if the law is effective it is important that it is well received so that it does not risk being repealed, thus considering how the tax revenue is used is an important consideration.

As noted earlier, an issue that studies have found in Philadelphia is that consumers are traveling outside of where the tax applies in order to buy the same sugary drinks without the tax. This is an issue that might be able to be solved if the tax were over a larger jurisdiction such as a county or even a state. This would prevent patrons from being able to avoid the tax by simply traveling to the suburbs.

Although there has been research showing that taxes have had positive impacts on weight loss (Powell et al., 2013), the negative externalities of consuming sugar do not arise solely from sugary beverages. If the goal is to completely eliminate the welfare loss from the negative externalities that arise from consuming sugar and its substitutes, then all sugar, high fructose corn syrup, or other sweetener containing beverages and foods would have to be taxed.

Another issue surrounding sugar taxes is their effect on food deserts. Those living in food deserts, or areas where the only food available is that from fast food restaurants and gas station convenience stores, often belong to lower socioeconomic levels (Ploeg, Dutko, & Breneman, 2015). If sugar taxes are levied in these areas then an issue of food affordability arises. If taxes were to be levied on all added sugar containing products this issue would be magnified even further. Although food desert populations also tend to have higher than average levels of obesity

and diet related diseases (ibid) and these taxes may help combat those statistics, increasing the price of food, even if it is only some of the food supply, without providing untaxed alternatives is not a viable solution as it would only put those living in food deserts at a greater disadvantage.

In the areas where sugar and soda taxes have been implemented there has been both positives and negatives observed. For the most part they are effective at doing what they were designed to do: limit consumption of sugar sweetened beverages. What they do not do though, is completely eliminate the negative externalities of sugar consumption. They fall short of doing this because the taxes being levied do not take marginal effect or damage into account and they only apply to certain drinks not to everything that has added sugar. Another issue that has been observed is that in some areas, consumers simply avoid the tax by shopping in nearby jurisdictions where there is not a tax. In order to fix these issues though, other problems arise such as creating more of a burden on already at-risk populations. There has also been cases of sugar sweetened beverage taxes being repealed which has been said to be due not because they were ineffective but because the tax revenue was not being used in a way that pleased the public.

Recommendations and Conclusion

Obesity, type two diabetes, and other diet related diseases have become major issues in the United States and around the world. Many have studied the causes of these diseases and many have speculated about what has led to the amount of sugar and its substitutes in our food system and the amount consumed by consumers. In his book *Fat Land*, Greg Critser popularized the theory that high sugar prices due to sugar quotas led to the invention of the cheaper high fructose corn syrup which has led to lower prices and a higher quantity supplied of sweetened food. This paper's study tested that theory and found that through applying economic theory, it

does not make theoretical sense. Examining data for sugar and high fructose corn syrup prices and consumption since the invention of high fructose corn syrup until the early 2000s, Critser's theory does not hold. High fructose corn syrup prices started to trend upward as early as 1997, which means his theory may have at one point held but at the time he published it, it no longer did. At around the same time *Fat Land* and other literature was published, the trend of increasing high fructose corn syrup prices became even more prevalent, so much so that sugar prices are now below that of high fructose corn syrup. High fructose corn syrup consumption has never been greater than that of sugar and is now falling steeply as sugar is holding relatively stable.

The theory popularized by Critser in *Fat Land* may have been true at one time, but since it was published there has been less overall consumption of caloric sweeteners which may be the result of the publicized concern of obesity and its causes. Despite this publicity and the introduction of low and no calorie sweeteners, the obesity and diet related disease epidemics are still plaguing our society. There is a need for further research on the prevalence these new sweeteners and the effect they have on the market.

Apart from looking at Critser's theory, this paper also examined different taxes that have been levied across the country in efforts to decrease the consumption of sugar and its substitutes. As a policy option to combat obesity and other diet related diseases, taxes have been placed on sweetened food and drinks, but mainly on sodas. There have been numerous case studies of these taxes which have found they are effective. However, due to some of the evaluated drawbacks discussed in this paper, there needs to be more research on the effectiveness of such taxes being implemented in addition to other policies such as subsidies that are implemented to encourage consumers to purchase healthier options such as fresh fruits and vegetables and drinking water.

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