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Does a Soda Tax Make Sense? A Dual-City Survey Study in Philadelphia and Oakland

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Abstract: The implementation of soda taxes as a public health measure to curb sugar-sweetened beverage consumption has gained significant attention in recent years. Through a dual-city survey conducted in 2017 and 2018, we gathered data on consumer behavior, merchant decision, and tax impact on beverage consumption patterns. The results of the DID study showed that after the implementation of the SSB tax in Philadelphia in 2017, the consumption of SSB beverages changed significantly. However, in Oakland, there was a slight change after 2018. Additionally, the tax has been well-received by a considerable portion of the population, with a majority expressing support for its continuation. However, combined with the data analysis, I found that under the influence of different consumer pass-through rates, the actual implementation effects of sugar tax in Philadelphia and Oakland are different. The consumption of SSBs in Philadelphia decreases and the consumption of alternative goods increases, while the consumption of SSBs and alternative goods in Oakland decreases significantly and simultaneously. This study will provide arguments for the debate on the effectiveness and acceptability of SSB taxes as a public health intervention by analyzing the reasons for differences in actual implementation of policies between the two cities, while providing new analytical directions for policymakers.

Keyword: Soda Tax, Merchant Decision, Pigovian Tax, Substitute Goods

1. Introduction

There are more and more evidences have proved that the added sugar would result in lots of disease, like T2DM, NALFD, and cardiovascular diseases [1-5]. The SSBs are as the major source of added sugar in the diet in the modern society. Take diabetes, for example, the United States spends significantly much on diabetes-related medical expenses, which according to statistics released by the IDF, in 2021 alone, the total expenditure on diabetes-related medical costs in the United States was nearly 38 billion dollars, and it was estimated to reach nearly 39 billion dollars by 2030.

Thus, SSB tax has been implied. The economic logic of SSB tax stems from the classic Pigovian tax principle (like taxes on tobacco, gas-guzzling cars and plastic bag): Taxing goods with negative externalities (SSBs) to reduce consumption and the associated external costs (health care expenditures), and align marginal social costs with marginal social benefits to improve social well-being and increase tax revenue. This article from the "soda tax" design roots is to explore the effectiveness of SSB tax [6-10].

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2. Methods

This study uses hierarchical analysis to compare the implementation of policies in the two regions. After discussion, I finally decided to analyze from the two aspects of business decision-making and consumer behavior. As for merchants' decisions, through literature search, I learned that SSB tax is essentially a tax on merchants, and merchants pass the tax on to consumers by raising commodity prices to reduce losses and offset their extra expenses. Through the analysis of commodity prices, some scholars come to the conclusion that the consumer pass-through rate of SSB tax is about 60%. This paper analyzes the merchant decision from the upstream market, that is, the change of the store's SSB purchase situation [11-15].

2.1. Merchant decision

The reaction of merchants to SS tax can be directly reflected by the changes of merchants' purchase before and after tax. I have made statistics on the changes in beverage purchases by businesses in Philadelphia and Oakland before and after the tax (Table 1 and Table 2).

Table 1: The business decision maker change about SSB tax In Philadelphia

The Merchant Decision Towards SSB Tax			
		Before(%)	**After(%)**
Taxable	**Diet soda**	**21.63**	**20.88**
	Energy drink	**9.13**	**9.40**
	Regular soda	**38.61**	**38.71**
	Sports drink	**6.39**	**5.67**
	Sweetened fruit drink	**3.13**	**3.53**
	Sweetened tea	**6.75**	**5.39**
	Total	**85.64**	**83.58**
None Taxable	**100 percent juice**	**5.14**	**5.95**
	Water	**5.11**	**5.98**
	Similac and cheerios	**4.11**	**4.49**
	Total	**14.36**	**16.42**

Table 2: The business decision maker change about SSB tax In Oakland

The Merchant Decision Towards SSB Tax			
		Before(%)	**After(%)**
Taxable	**Energy drink**	**5.22**	**5.76**
	Sweetened fruit drink	**4.25**	**4.28**
	Regular soda	**39.35**	**39.13**
	Sports drink	**4.02**	**3.73**
	Sweetened tea	**4.13**	**4.02**
	Total	**56.97**	**56.92**

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Table 2: (continued).

None Taxable	Diet soda	21.79	21.55
	100 percent juice	5.63	4.44
	Comparisons	9.24	10.17
	Water	6.37	6.92
	Total	43.03	43.08

Note: Comparisons are alternative goods that are not subject to SSB tax, such as similac and cheerios, etc

The results show that in the face of SSB tax, the sales tendency of merchants in both places has been adjusted to a certain extent. But compared to the obvious change in Philadelphia; In Oakland, there was no significant change in the sales of different types of beverages. However, it is clear that there will be some merchants who choose not to sell beverages subject to SSB tax, and similarly, merchants will increase sales of beverages subject to SSB tax.

2.2. Consumer behavior

In the Data Set, the comparison community is set, so the DID method can be used to judge the change of consumer behavior. For beverages subject to SSB, the changes before and after the tax were calculated based on whether the sample was in the comparison community to divide into treatment group(Philadelphia) and control group(simulating the population and economic level of Philadelphia). Meanwhile, the results of DID were calculated for beverages with no SSB tax in Philadelphia and for beverages with SSB tax and no SSB tax in Oakland. (Table 3 and Table 4)

Table 3: The result of the DID method in Philadelphia

The Influence Of The Consumption About The SSB Tax In Philadelphia			
	Treatment(ounce)	Control(ounce)	Difference(ounce)
SSB Beverage	-6.93	4.38	-11.31
Untaxable Drink	-0.23	-4.39	4.16

Table 4: The result of the DID method in Oakland

The Influence Of The Consumption About The SSB Tax In Oakland			
	Treatment(ounce)	Control(ounce)	Difference(ounce)
SSB Beverage	-5.86	-0.67	-5.19
Untaxable Drink	-2.75	1.30	-4.05

3. Conclusion

The results show that without the intervention of the SSB tax, the daily SSB consumption in Philadelphia would increase by 4.38 ounces per year and the non-SSB would decrease by 4.39 ounces per year. However, with the introduce of the SSB tax, SSB consumption decreased by an additional 11.31 ounces and non-SSB consumption increased by an additional 4.16 ounces. However, in

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Oakland, the SSB tax decreased an extra 5.19 ounces to SSB consumption and an extra 4.05 ounces to non-SSB consumption.

Analysis of the results in Table 1-4 shows that consumers have substitution behavior. Under normal circumstances, SSB and non-SSB beverages that are not taxed are substitute for each other, and the increase in the price of SSB leads to a decrease in the demand for SSB and an increase in the demand for non-SSB as a substitute commodity. Therefore, observing the results of the policy implementation in Philadelphia, SSBS increase consumption and non-SSBs decrease consumption without intervention; After the SSB tax was levied, the demand for SSB decreased significantly. Consumers have switched to other drinks that are not affected by the tax. This shows that the implementation of the policy is meaningful which can achieve the purpose of reducing residents' SSB consumption.

However, in the Oakland, when intervention factors were not involved, residents decreased SSB intake and increased non-SSB intake. After the introduction of the SSB tax, although the residents reduced the intake of SSB, they also reduced the consumption of non-SSB. In other words, in the face of the SSB tax, Philadelphia residents choose to increase the purchase of alternative goods to cope with the additional expenses; And Oakland residents chose to reduce all beverage purchases to resist the SSB tax.

So, Philadelphia's SSB tax makes sense, and Oakland's SSB tax makes no sense.

4. Discussion

Residents have significantly reduced their consumption of all beverages, which is bad for government tax revenue.

The end result of the study was just the opposite. 1. Philadelphia and Oakland are located on the east and west coasts of the United States respectively, so there are many different factors such as geographical factors and social factors. 2. In terms of economics, based on the analysis of the classical Pigouvian tax principle, the principle of SSB tax is to tax SSB drinks, thereby raising prices and reducing demand, reducing residents' intake of added sugars and increasing the government's tax revenue. According to Marshall's price elasticity principle, commodities have price elasticity (price elasticity is affected by many factors such as commodity category and consumer consumption behavior). Commodities are flexible, prices rise and consumption falls; Inelastic goods, prices rise, consumption may stay the same or even rise. Therefore, it is certain that SSB commodity price elasticity. However, the price elasticity of alternative commodities non-SSBs needs to be further determined. This study proves that the government's tax decision-making should also consider the characteristics of commodities such as substitute commodities and complementary commodities.

5. Research Gap

In the subsequent research, cross-disciplinary data analysis can be carried out. In addition, the government collects the SSB tax not only for the health of residents, but also for the purpose of increasing tax revenue. Therefore, to discuss the effectiveness of the policy, it is also necessary to analyze the number of tax revenue and the use of tax revenue.

In addition, this paper analyzes changes in merchants' sales and changes in consumers' consumption of SSB for policy assessment, and evaluates the implementation of SSB tax policy from the perspective of producers to make statistics on changes in SSB transactions in the primary trading market and whether SSB production is reduced or whether the production of non-SSB beverages as substitute commodities is increased. In addition, there is a lack of long-term data support for the implementation of SSB tax, and the actual effect can be reflected by analyzing medical expenditure.

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So, in my opinion, the 1.5 cent per ounce sugar tax in the Philadelphia has received positive feedback from businesses and has effectively reduced residents' consumption of SSBs by passing it 100% to consumers, and it has also increased government revenue. However, a sugar tax of 1 cent per ounce on some SSBs in the Oakland has been met with negative feedback from businesses as it has not been fully passed on resulting in additional costs for businesses and a decline in consumer consumption of all beverages, which is contrary to the government's fiscal objectives.

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