Do Soda Taxes Promote Healthy Consumption?

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Abstract

Soda taxes have been proposed and used as levers to encourage healthy consumption behavior. While the existing literature has aimed to answer whether soda taxes change behavior, little is known on *how* they change consumer behavior. Do soda taxes encourage healthy habit formation or do they work primarily as a price deterrent? To answer this question, we use a unique setting in Cook County where a soda tax was introduced and repealed soon after. Using this natural experiment combined with household-level data, we not only observe a reduction in sugar-sweetened beverages during the tax, but can also test whether behavior reverted to pre-tax levels or continued to follow during-tax levels after the tax was terminated. Our overall findings indicate that consumption largely reverts to pre-tax after the tax was terminated. However, examining heterogeneous responses, the tax had a positive impact on the purchase behavior of diabetic households. Taken together, we find that taxes are not only successful in the short-run, but can have beneficial longer-run effects on certain susceptible populations.

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Researcher(s)' own analyses calculated (or derived) based in part on data from Nielsen Consumer LLC and marketing databases provided through the NielsenIQ Datasets at the Kilts Center for Marketing Data Center at The University of Chicago Booth School of Business. The conclusions drawn from the NielsenIQ data are those of the researcher(s) and do not reflect the views of NielsenIQ. NielsenIQ is not responsible for, had no role in, and was not involved in analyzing and preparing the results reported herein.

1 Introduction

Soda taxes have been used as a policy lever to improve consumers' health outcomes by reducing consumption of sugary beverages. Taxes can change behavior for multiple reasons: by exerting a direct demand effect through raised prices, by causing consumers to explore other alternatives leading to healthy consumption habits or by making the new taxed price seem costlier (over and above the direct price effect, e.g. a reference price effect). The existing literature typically observes a one-time change in tax regime making identification of which of these effects might be at play challenging. Using a unique setting, where a tax was not only introduced but also terminated, this paper aims to understand if consumers learn healthy behavior and continue to consume less, revert to their original consumption levels or consume more after the tax was terminated.

In Cook County, a sugar sweetened beverage (SSB) tax was implemented in August 2017. Facing pressure from multiple fronts including consumers and lobbyists, the Cook County SSB tax was repealed after four months on December 2017. This setting enables us to measure behavior after the tax policy was implemented and after it was repealed.

Three possible behaviors can emerge after the tax repeal: First, if the tax decreased purchases, consumers might be accustomed to consuming less of the SSBs during the tax period and might continue to consume less after the repeal than they did before the tax. Such behavior is consistent with habit formation and learning (Becker and Murphy, 1988), and is ideal from a policy makers' perspective as it reduces consumption of SSBs even in the absence of the policy intervention. Second, if there is no such learning effect and if consumers just respond to the tax as a price lever, they would revert to their original consumption levels after the tax was terminated. Third, consumers might consume more SSBs after the repeal. For example, if SSBs appear cheaper after the tax repeal relative to during the tax period, it can lead consumers to buy more at this "cheaper" price (such a pattern would be consistent with the reference price literature. See Kalyanaram and Winer (1995) for an overview).

This paper uses detailed household-level panel data from Nielsen to understand consumer

behavior. Unlike the existing literature that has used aggregate store-level sales data with strong assumptions on individual shopping patterns, using individual level data enables observing the complete consumption pattern at the individual shopper's level. Moreover, likely because of the aggregate or cross-sectional nature of the data used in the existing literature, we see mixed findings documented. On one hand, some studies have shown that taxes are successful at reducing consumers' sugar consumption (e.g., Falbe et al., 2016; Lee et al., 2019, both of which use repeated cross-sectional surveys). On the other hand, other studies have found that while sales at taxed locations decline, the sales at nearby non-taxed locations increase (e.g., Seiler et al. 2021; Roberto et al. 2019; Powell et al. 2020*a* all of which use store-level sales data). With aggregate store-level data alone, it is hard to distinguish if individuals at the taxed locations increased purchases at the non-taxed locations, or if individuals at the non-taxed locations shopped more[1] at those non-taxed locations. Using individual-level data helps keep the unit of analysis at the individual, enabling measurement of changes in the individual's consumption levels. Moreover, while cross-border shopping is of interest to retailers, individuals' consumption of sugar/soda is of primary concern to policy makers.

Our empirical analysis uses a differences-in-differences-in-differences approach where consumption of SSBs at the individual-level after the tax was terminated is compared to consumption levels during the tax and before the tax was levied, relative to control regions and relative to a control year. Because the tax was implemented only in Cook County, all adjacent counties (DuPage, Kane, Lake, McHenry, Will) serve as controls. The previous year, 2016, is used as a control year to control for time trends and seasonality, e.g., SSB consumption might be higher in summer. To ensure we do not capture effects related to the tax immediately before the tax was implemented, we do not use the 9 weeks immediately preceding the tax implementation date as a baseline and instead use the 9-week window

[1]For example, one theory, in line with the reference price literature, that would support such behavior is if individuals at the non-taxed locations feel that their prices are cheaper because they do not face the tax unlike their neighboring locations.

before that as our baseline period, which we refer to as the pre-tax period.

Because certain populations might be more susceptible to health repercussions from consuming SSBs, we also examine heterogeneity by consumers' health conditions. To do so, we use NielsenIQ's Health Care Survey which identifies if any household member was suffering from specific ailments. We focus specifically on diabetes and obesity - two ailments which are closely tied to consumption of SSBs (e.g., Malik et al., 2010), and where a policy lever such as a soda tax can play a significant role. We therefore explore heterogeneous responses to the tax by households suffering from diabetes and obesity.

First, examining overall responses, we find that consumption decreases during the tax, but returns to pre-tax levels once the tax is terminated. At the aggregate level, this finding rules out healthy habit formation, i.e., although consumers consume less SSBs during the tax they do not hold on to this healthier behavior after the tax is lifted. We also do not find evidence supporting over-consumption (either because of curbed demand during the tax or the SSBs appearing cheaper once the tax is lifted) after the termination of the tax.

However, examining heterogeneous responses, we find changes in consumption behavior for those with diabetes. Specifically, for diabetic households, we find that purchases after the tax was terminated does not revert to pre-tax levels, and this behavior is sustained even over the longer-term (16 weeks). During the tax regime, weekly purchases of diabetic households drop by approximately 45 oz, a 40% decrease, and post-tax purchase levels exhibit a sustained decline in purchases. This finding is promising and suggests long-term positive health consequences for populations that are likely to benefit from reducing sugar consumption.

Our goal is to measure the total effect of the tax and its termination which includes responses over and above the price change. Multiple changes often accompany a policy change, especially one as controversial as a SSB tax. For example, media coverage accompanying the tax and its termination, public interest, lobbying efforts, price changes affected by manufacturers in response to the tax are all likely to be different around the policy implementation (Rees-Jones and Rozema, 2023; Taylor et al., 2019; Allcott et al., 2019*b*). We consider all

of these to be effects of the tax and do not aim to separately measure the effect of each of these.

We contribute to the literature in three ways. First, a vast literature has studied soda taxes and their effect on consumer purchases finding an overall decrease due to the tax (see Teng et al., 2019, for a review). We extend this literature by documenting how such taxes might work by analyzing behavior when the tax is lifted, which enables us to understand whether the behavior is sustained, reverts to pre-tax behavior, or worsens. Aprioi it is unclear which of these effects will manifest.

Second, most research that comments on policy implications of soda taxes has examined purchases at the aggregate store level (e.g., Seiler et al. 2021; Roberto et al. 2019; Powell et al. 2020*a*), and not at the individual household-level. However, health policy effects of taxes are related to individuals rather than stores. While store-level analysis is of interest to retailers it does not shed light on how individual consumers change their behavior.

Third, analysing individuals has the added benefit of helping understand how specific groups of individuals are impacted by the tax. While it has been purported that soda taxes are aimed at improving public health outcomes and consuming SSBs are linked to obesity and diabetes, to our knowledge very little empirical work has examined behavior of these specific populations. The lack of empirical work in this domain is largely due to limited data availability on households' health conditions. Using a novel dataset where we can observe households' ailments we contribute to the literature by understanding if there exists any heterogeneity across various sub-groups of interest.

1.1 Consumer Behavior and Empirical Predictions

When the tax is lifted, consumer purchases can increase, stay the same, or decrease relative to the pre-tax levels. Below we delineate reasons why each of these scenarios might occur.

Reversion to pre-tax behavior can occur for two main reasons. First, if taxes work by exerting a pure demand effect, such a demand response to an increase in price will manifest

as a reversion once the price increase no longer exists. Rojas and Wang (2021) document a 5% decline in purchases due to the Washington soda tax where the price increase due to the tax was likely to be the main factor; other factors such as media coverage, publicity and awareness were unlikely due to the swift enforcement of the tax which took the industry by surprise. Second, if the tax creates negative associations with SSBs, similar to "sin" tax designations, then removal of the tax might signal to the consumer there is no such negative association leading to a reversion. Such a negative response has been documented in Taylor et al. (2019) where the decline occurred immediately after the tax was voted in by a majority, months before the tax was implemented, a finding consistent with consumers updating their beliefs, making inferences and learning about adverse health outcomes that otherwise might have been unknown to the consumer.

Decline in purchases relative to the pre-tax period. A decline in the post-tax period can occur if consumers learn healthy behavior and continue that learned behavior even in the absence of the tax. Such behavior is consistent with models of rational addiction (Becker and Murphy, 1988) where sustained price changes might be needed to effect behavior change in addictive goods. Evidence for sustained preferences and preference formation has been shown to occur in Bronnenberg et al. (2012) and Bronnenberg et al. (2022) in the context of consumer packaged goods and beer respectively. In the context of soda taxes, groups that might have the strongest incentives to change behavior (e.g., those with diabetes) might benefit the most from soda taxes. Allcott et al. (2019*b*) suggest that consumers might be unable to understand the long-term consequences of consuming SSBs or may have imperfect information about its harmful effects in which case a policy such as soda tax can help.

Increase in purchases relative to the pre-tax period. An increase in purchases can occur if sodas, after the tax is lifted, appear much cheaper relative to the taxed price. Such behavior is consistent with asymmetric responses to price decreases relative to a price increase by the same amount and is in line with the predictions of prospect theory (Kahneman and Tversky, 1979). Such asymmetric responses have been documented for example in Bell

and Lattin (2000) and Krishnamurthi et al. (1992). An increase is also consistent with intertemporal substitution, for example if consumers consumed from their beverage inventory during the tax and make up for the resulting reduced inventory after the withdrawal of the tax.

These different accounts may make similar predictions about what happens when the tax is implemented, but make different predictions about what happens when the tax ends.

2 Data and Empirical Setting

2.1 Tax Implementation, Timeline and Termination

The Sweetened Beverage Tax (SBT or SSB tax) was implemented in Cook County on August 2, 2017. The tax imposed a 1.00 cent per fluid ounce tax on the retail sale of all sweetened beverages (https://www.cookcountyil.gov/service/sweetened-beverage-tax, Accessed May 2022). On October 10, 2017, Cook County announced the repeal of the tax and the SSB tax was terminated two months later on December 1, 2017. Figure 1 provides the timeline of all events that we go over in detail below.

Although the tax went into effect on August 2, 2017, the soda tax received press coverage prior to the actual implementation date (e.g. CNBC 2017, CookCountyIL.gov 2017). A google trends search confirms interest in the Chicago soda tax beginning in June 2017 with very little to no searches before June (see Figure A1 in Appendix A). Therefore, we define the baseline and transition periods in close accordance with these events.

Pre-Tax As the baseline period, we use the 9 weeks prior to the transition period starting April 1, 2017. This serves as a reference because consumer behavior is unlikely to be impacted by any soda tax related information in this period. We verify this to be the case using purchase behavior during this period relative to the preceding months and find no change in behavior.

Transition If consumers are forward-looking, knowing that the soda tax will soon come into effect, they might stock up on sodas to avoid paying the additional tax. To account for this possibility, we treat the 9 weeks immediately preceding the tax implementation as a transition period. This period definition is also in line with the Google search volume increase on this topic (Figure A1 in Appendix A).

During Tax The tax was implemented on August 2, 2017 and was in effect until December 1, 2017 when it was repealed. However, because the termination was announced on October 10, 2017, we divide this period into two distinct phases: a pre-announcement (During Tax I) and a post-announcement (During Tax II) phase. Both periods are during the tax, but the post-announcement phase might involve strategic behavior where consumers postpone consumption in anticipation of the tax ending. Therefore, we might expect to see an additional dip in purchases during this phase that is related to intertemporal substitution.

Post Tax Finally, the 9 weeks following tax termination comprise the Post Tax period. In analyses which uses the longer-term window we include the 16 weeks following the tax termination in the Post Tax period.

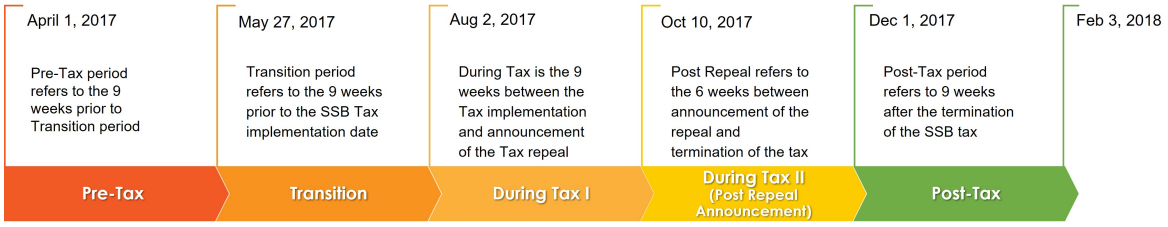


Figure 1: Timeline of SSB tax-related events in Cook County

2.2 Tax is reflected at checkout and is not passed-through

Unlike most soda taxes, which are levied at the distributor/bottler level which is in turn passed through to the end consumer, the Cook County tax was collected at the register, at the point of purchasing the basket of goods. The images below show how the tax was imposed. Figure 2 shows receipt images in Cook county for taxed beverages. Note that the tax is a separate line-item in each of these receipts and is not included in the price of the beverage. Figure 3 highlights the messaging that some retailers used stating "This item is applicable for the Cook County sweetened beverage tax, one penny per ounce, tax amount will be available on receipt at checkout".

As a result, any price increases observed in the NielsenIQ data cannot be interpreted as a tax pass-through, but an indirect effect of the tax (e.g., retailers increasing prices). Therefore, we present two sets of results: one that does not control for any changes in prices and another that does, through a price index. The first set of results should be interpreted as the overall effect of the tax policy. The second set of results which controls for prices showcases how much of the effect is due to other factors related to the tax (e.g., attention to the tax, inferences made about health implications because of the tax) holding prices fixed.



Figure 2: Cook County Tax Implemented at Checkout



Figure 3: Cook County Tax Shelf Messaging

2.3 Impacted Products

The tax impacted sugar sweetened beverages (SSBs) and artificially sweetened beverages (ASBs). The four main categories under SSBs are Soda Drinks, Juice Drinks, Coffee and Tea Drinks and Cocktail Mixes, and the primary category under ASB is Diet Soda.

It is unclear whether artificially sweetened beverages have similar health repercussions as sugar sweetened beverages. While SSBs are directly relevant from a policy perspective, given the linkage between consumption of additional sugars and various adverse health outcomes, it is unclear whether diet sodas should be taxed (see for example WorldBank 2023). On one hand, studies have shown that SSBs (and not ASBs) are more closely linked to diabetes (e.g., Ma et al. 2016; Imamura et al. 2015). On the other hand, it has also been suggested that diet sodas are not entirely harmless (PennMedicine 2022). Therefore, understanding whether consumers respond differently to the tax policy for SSBs relative to ASBs, provides a relevant input to policy makers aiming to understand what kinds of products should be taxed. We examine consumer responses to the tax and its termination for these two sub-categories separately in Section 3.2.

Categories that are not subject to the tax include Water, Sparkling Water and 100% Juices, all of which contain no added sugar.

2.4 Natural Experiment

The SSB tax was implemented in Cook Country. Adjacent counties (DuPage, Kane, Lake, McHenry, Will) serve as controls. These counties geographically border Cook County (Figure 4) but are not subject to the SSB tax. As a robustness check, we use Milwaukee, which is comparable to Cook County due to its large population and metropolitan nature, as an alternative control.

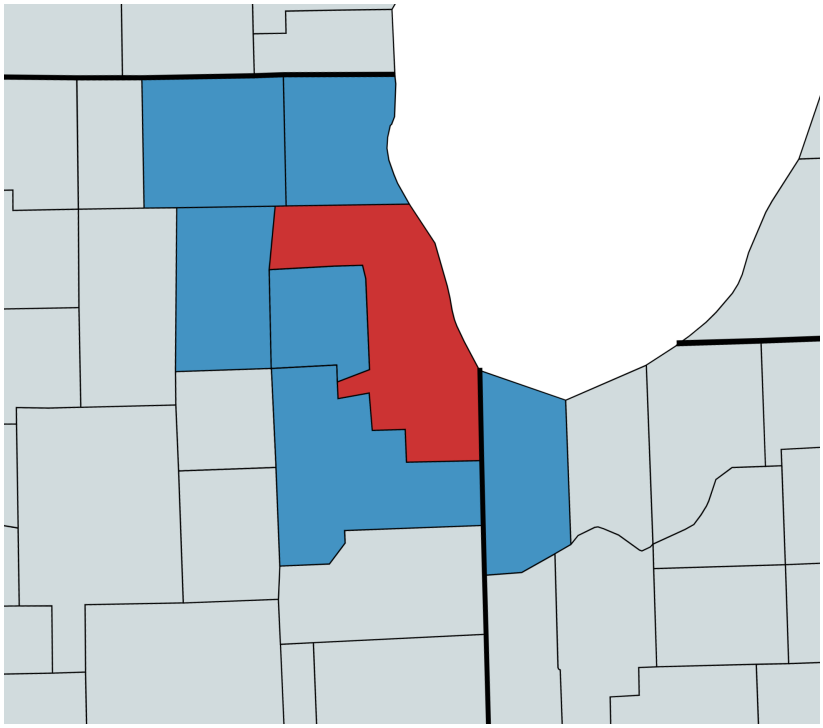


Figure 4: Adjacent Counties (blue) that border Cook County (red)

Using data from Nielsen's HMS panel, we restrict attention to households in the treated region (Cook County) and households in the control regions (adjacent counties). We keep only purchases in the categories of interest (SSBs, ASBs, water, sparkling water and 100% Juices) that occurred between April 2016 - February 2017 and April 2017 – February 2018. While the period from April 2017- February 2018 is directly relevant to the tax period and

provides a description of what happened during the tax and after the tax relative to the pre-tax period, the previous year (April 2016 - February 2017) serves as a placebo helping capture any seasonality or time trends in demand.[2] Only households that have purchased at least once during the timeframe are included. Weeks where a household did not make any purchase are also included and the volume purchased is recorded as a zero. Inclusion of such zero-purchases helps ensure we capture all types of reductions in consumption including complete reductions.

Household purchases within a category (e.g., Soda) are aggregated to the weekly level. As shown in Figure 1, the pre-tax period consists of the 9 weeks (week 1 to week 9 from April-May) prior to what we refer to as the transition period. The transition period, which consists of the 9 weeks immediately prior to the implementation of the tax, is included as a separate period to allow for the possibility that consumers, anticipating the upcoming SSB tax, might have altered their behavior, such as by stocking up before the expected price increases. The tax was in effect over the next 9 weeks (August to October). The following 6 weeks (October to December) correspond to the post-repeal announcement period. In our analysis, we distinguish between the during-tax period and the post-repeal announcement period, to test if there are any significant changes in response to the post-repeal announcement. Finally, the post-tax period consists of the subsequent 9 weeks (December to February) to match the pre-tax and during-tax periods. Because the SSB tax was terminated in December, the post-tax period continues into the following year. Additionally, we include a longer post-tax period in our analysis to account for any long-term changes in consumption behavior. This extended post-tax period covers 16 weeks after the termination of the SSB tax. We limit the long-term analysis to 16 weeks to ensure the placebo year (previous year's post-tax period) does not overlap with the pre-tax period. In other words, a longer post-tax, say 20 weeks, period would make the placebo post-tax period end in April 2017 which would overlap with

[2]For analysis considering a longer Post Tax period we use April 2016 – April 2017 and April 2017 – April 2018. The longer Post Tax period helps test whether the long-term purchase behavior is different from the short-term purchase behavior once the SSB tax was terminated.

our treated pre-tax period which begins April 2017. To avoid any noise during the dates of the actual policy changes, weeks pertaining to the implementation, announcement of the repeal, and termination are excluded.

2.5 Empirical Specification

The main dependent variable is the weekly volume (in ounces) of SSBs purchased. Using a differences-in-differences-in-differences design, we compare weekly volume of soda consumed in a period of interest (e.g. post-tax) to the weekly volume consumed before the tax, i.e., in the pre-tax period, relative to the same periods in a control year (2016) and the control region (adjacent counties). Using the pre-tax period as the reference, allows us to test directly how behavior at various periods changed in response to the tax.

For each category considered (e.g., Soda, Diet Soda, All Taxed Beverages), we estimate the following regression separately:

$$\begin{aligned} y_{it} = \beta_1 \text{Cook}_i + \beta_2 \text{TaxYr}_t + \beta_3 \text{Cook}_i \times \text{TaxYr}_t + \sum_{Period} \gamma_{0,Period} Period_t + \\ \sum_{Period} \gamma_{1,Period} Period_t \times \text{Cook}_i + \sum_{Period} \gamma_{2,Period} Period_t \times \text{TaxYr}_t + \\ \sum_{Period} \gamma_{3,Period} Period_t \times \text{Cook}_i \times \text{TaxYr}_t + \alpha_i + \epsilon_{it} \end{aligned} \tag{1}$$

where $Period \in \{Transition, DuringTaxI, DuringTaxII, PostTax\}$

In equation 1, y_{it} is the weekly volume of beverage purchased by household i in week t; $\text{Cook}_i = 1$ if household i lives in Cook county and $\text{TaxYr}_t = 1$ if week t corresponds to the year the tax was implemented, i.e. 2017. The four distinct time periods are captured by $Period \in \{Transition, DuringTaxI, DuringTaxII, PostTax\}$ which are indicator functions for the time periods corresponding to the transition, during tax but before the announcement of the tax repeal, during tax and post repeal announcement and Post-Tax periods as defined

in Figure 1. These are indicators for the respective weeks in both the treated and untreated years. The additional effects corresponding to the year the tax was implemented are therefore captured by the coefficients $\gamma_{2,Period}$ corresponding to $Period_t \times \text{TaxYr}_t$. The main coefficients of interest are $\gamma_{3,Period}$ corresponding to the treatment effects of the transition, during tax, during tax and post repeal announcement and tax termination, respectively, in Cook County in 2017 relative to the baseline (relative to adjacent counties and the placebo year 2016).

The regression controls for household fixed-effects, α_i, to account for varying consumption levels of different households and clusters at the individual household level.

In addition to the specification is Equation 1, we conduct another analysis which controls for any price changes, through a price index, in the periods of interest. While equation 1 allows us to understand changes in consumer behavior as a net effect of the policy, it is of interest to know how much of these changes are likely to be driven by manufacturer-implemented changes in prices. Controlling for price changes allows us to compare changes in behavior had prices not changed.

We construct the Price Index, PI_{it}, as follows. For each county[3], we create a weighted sum of weekly prices of the top 50 beverages relative to the weighted sum of prices during a pre-tax period (the 9 weeks prior to the transition period in 2017). The share of quantity purchased of each beverage is used as the weight. The equation for the price index for a given county that household i belongs to, in week t is as follows:

$$\text{PI}_{it}^{County} = \frac{\sum_{j=1}^{50} s'_j p_{ijt}}{\sum_{j=1}^{50} s'_j p'_j} \tag{2}$$

where $j \in \{1, 2, \ldots, 50\}$ denotes the 50 beverages that were sold the most in that county during the pre-tax period (9 weeks prior to the transition period). p_{ijt} denotes the price of beverage j that a household i faces in week t in her store. When p_{ijt} is not available at the store-level (e.g., no purchases of beverage j that week in that store), county-level averages are used. p'_j and s'_j denote the average price and share of beverage j in household i's county

[3]We also use a household-specific PI, see 3.1.1.

during the pre-tax period.

When controlling for the PI, we estimate equation 3, with the only difference from equation 1 being the term ηPI_{it}:

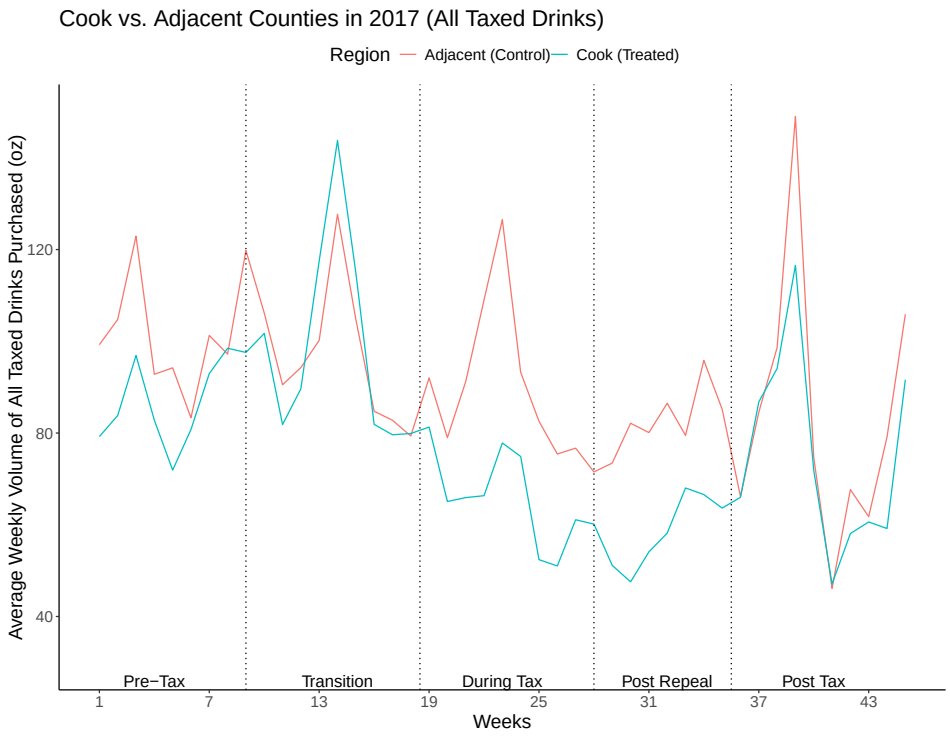
$$\begin{aligned} y_{it} = \beta_1 \text{Cook}_i + \beta_2 \text{TaxYr}_t + \beta_3 \text{Cook}_i \times \text{TaxYr}_t + \sum_{Period} \gamma_{0,Period} Period_t + \\ \sum_{Period} \gamma_{1,Period} Period_t \times \text{Cook}_i + \sum_{Period} \gamma_{2,Period} Period_t \times \text{TaxYr}_t + \\ \sum_{Period} \gamma_{3,Period} Period_t \times \text{Cook}_i \times \text{TaxYr}_t + \eta \text{PI}_{it} + \alpha_i + \epsilon_{it} \end{aligned} \tag{3}$$

where $Period \in \{Transition, DuringTaxI, DuringTaxII, PostTax\}$

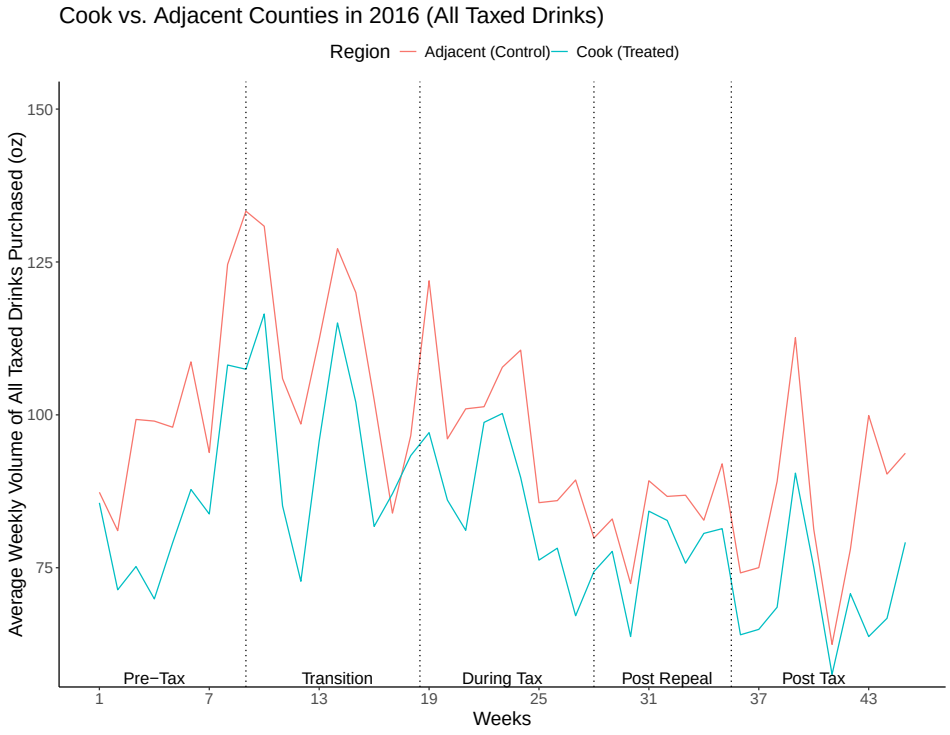
The differences-in-differences-in-differences specification is illustrated in Figure 5. Figure 5 shows the average weekly volume of SSBs purchased for consumers in Cook County and the adjacent counties in 2017 (Figure 5a) and 2016 (Figure 5b) in the five periods of interest: pre-tax, transition, during tax I, during tax II and post tax.

Three patterns are worth noting in these figures. First, Figure 5b, which shows SSB consumption levels in the control year of 2016, shows that adjacent counties serve as a good control for Cook county - the trends are largely parallel. Second, Figure 5a shows that, in the treated year of 2017, the period during the tax (including the post-repeal announcement period) sees a decline in consumption relative to both the pre-tax period and the adjacent counties in 2017. This pattern does not exist in 2016 (control year) suggesting the soda tax had a negative impact on SSB purchases. Last, it can be seen that after the tax is terminated, Cook county consumption levels revert to pre-tax and parallel the patterns in the adjacent counties in 2017.

In the next section, we account for differences in household-level consumption levels by estimating the full specification with household-level fixed effects (Equation 1) as well as controlling for any changes in prices (Equation 3) to quantify the magnitude and statistical significance of these effects.



(a) Cook and the adjacent counties: The year the tax was implemented (2017)



(b) Cook and the adjacent counties: Placebo Year (2016)

Figure 5: The averaged weekly volume of All Taxed Beverages purchased for consumers in (a) 2017 and (b) 2016

3 Results

In this section, we first present the overall results followed by a detailed examination of subcategory specific analysis and heterogeneous responses by the type of consumer.

We present two sets of results - one that measures the overall effect of the tax, and another that controls for any price changes implemented by manufacturers/retailers during the tax period through the Price Index. The results with the Price Index showcase the effects of the tax policy by making prices comparable to the prices before the tax.

3.1 Overall Analysis

Table 1, Column (a) presents the results of the regression specified in Equation 1. We report the results for all taxed beverages, as well as only the sugar-sweetened beverages (excluding Diet Sodas). The baseline is the pre-tax period (Figure 1), and all behavior is measured relative to purchases in the pre-tax period. Figure 6 plots these estimates (reported in Column (a) of Table 1).

First, we see evidence of stockpiling, where the purchases of taxed beverages increased by 14.71 oz in the transition period.

Second, during the tax period we see a decrease of -15.81 oz and -21.42 oz respectively in the two distinct phases we define (during tax I and during tax II which is the period after the announcement of the tax termination). Finally, after the tax was terminated, the purchases revert to the pre-tax level: purchases in the post-tax period are 5.86 oz higher but statistically indistinguishable from the baseline period.

While some of the decline in the post repeal period can come from strategic postponement of purchases until the tax is lifted, we see an overall decline in purchases of all taxed beverages. Because each of the five periods are roughly 9 weeks each, a back-of-the-envelope calculation summing all the estimates shows that the net decline amounts to a 16.6 oz decline in purchases. With a mean purchase volume of 88.42 oz in the pre-tax period, these numbers

translate to a 19% decline, suggesting an economically meaningful impact of the tax.

Table 1, Column (b) presents the results of the regression specified in Equation 3. These estimates show that, after accounting for price changes through the Price Index, the results continue to hold although the decline is less stark,implying a large portion of the decline during the tax is driven by other factors related to the tax, a finding consistent with Rojas and Wang (2021) and Taylor et al. (2019).

Our findings suggest that the SSB tax reduces the purchase of taxed beverages through a combination of policy implementation and price changes.

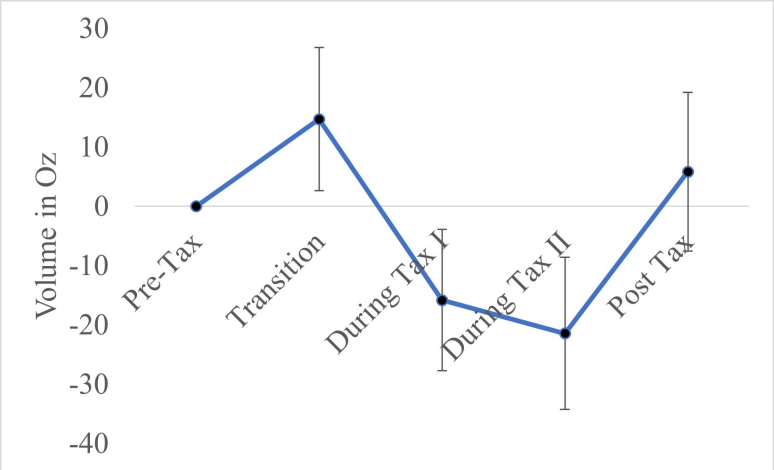


Figure 6: Change in Purchase Volume: D-D-D Estimates

Table 1: Effects of the tax relative to the pre-tax period: D-D-D Estimates

	(a)	(b)
	Without PI	With PI
All Taxed Beverages		
2017 X Cook X Transition	14.71**	15.9**
	(6.15)	(6.18)
2017 X Cook X During Tax I	-15.81***	-12.29**
	(6.08)	(6.12)
2017 X Cook X During Tax II	-21.42***	-14.61**
	(6.55)	(6.76)
2017 X Cook X Post-Tax	5.86	7.25
	(6.83)	(6.86)
Pre-Tax Cook Mean (oz)	88.42	
N Observations	165,858	
N households	2,249	
SSBs		
2017 X Cook X Transition	9.71*	10.68**
	(5.05)	(5.08)
2017 X Cook X During Tax I	-8.5*	-5.59
	(4.94)	(5.06)
2017 X Cook X During Tax II	-16.13***	-10.02*
	(5.48)	(5.69)
2017 X Cook X Post-Tax	1.92	3.93
	(5.73)	(5.79)
Pre-Tax Cook Mean (oz)	64.53	
N Observations	161,196	
N households	2,216	
Controls	2016 + Adj. Counties	
Fixed Effect	Household	
Clustering Level	Household	

*p<0.1; **p<0.05; ***p<0.01

Notes: The dependent variable is volume of beverage purchased in oz. All Taxed Beverages include all SSBs and Diet Soda. SSBs include all sugar-sweetened beverages but not Diet Soda. All estimates are relative to the baseline Pre-Tax period consisting of the 9 weeks before the transition period. During Tax I refers to the period during the tax before the announcement of the tax termination, while During Tax II refers to the period after the announcement. The duration of the Post Tax period is 9 weeks after the termination of the SSB tax. Clustered standard errors in parentheses.

3.1.1 Robustness Checks

In this section, we present four main robustness checks. First, we show that our results hold using Milwaukee as an alternative control. Second, we show that our results are robust including a longer-term window (16 weeks). We also show that our results are robust to using household-level PI as a control for changing prices. Finally, we examine purchases of Untaxed Beverages as a placebo check.

Milwaukee as a Control Our main analysis uses adjacent counties as a control group. Another potential control is Milwaukee, which being a larger city, is closer in size and characteristics to Cook County. Table B1, Column (c) in Appendix B present the results, showing our results are robust to this alternative control.

Longer post-tax period Our main analysis uses a 9-week period after the termination of the tax to estimate post-tax effects. Here, we test whether the effects sustain in a longer period. We use 16 weeks as our chosen duration for the longer post-tax period, because any duration longer than that (in the placebo year) would begin overlapping with the pre-tax period in the treated (tax) year. To be precise, the 16 week post-tax period ends on April 2017 in the placebo year and on April 2018 in the treated (tax) year. The pre-tax period in the treated year begins April 2017. A longer post-tax duration would end after April 2017 in the placebo year overlapping with the pre-tax period in the treated year. Table B1, Column (b) in Appendix B shows the impact of the tax for a longer post-tax period showing that purchases revert to pre-tax periods even in the longer-term.

Controlling for prices using a Household-Level PI Our main analysis uses county-level price index, constructed as shown in Equation 2 above. As a robustness, we also create a household-specific PI, where for each household, we use the prices of the Top 5 UPCs they purchased in week t relative to the pre-tax period (9 weeks prior to the transition period in 2017), and use the share of quantity purchased of each beverage in a household, s_{ij} , as

the weight. For households without any purchase during the period, the county-level price index, which is described above, is assigned. The equation for the price index for household i in week t is as follows (assuming that household i has purchased during the pre-tax period):

$$\text{PI}_{it}^{Household} = \frac{\sum_{j=1}^{5} s'_{ij} p_{ijt}}{\sum_{j=1}^{5} s'_{ij} p'_{ij}} \tag{4}$$

where $j \in \{1, 2, \ldots, 5\}$ denotes the 5 beverages that household i most frequently purchased during the pre-tax period, p_{ijt} denotes the price of beverage j in week t faced by household i, and p'_{ij} and s'_{ij} denote the average price and household-specific share of beverage j during the pre-tax period for household i. Table B2, Column (b) in Appendix B shows that our results are robust to using either measure of Price Index.

Untaxed Beverages In this robustness, we check to see if untaxed beverages experienced any change as a placebo check. Specifically, if we see a decline similar to taxed beverages, one might be concerned that other factors (and not just the tax) might be influencing beverage consumption of taxed beverages in Cook county. An increase in purchases of untaxed beverages or no change are both reasonable expectations. We might expect to see an increase if consumers substitute to these beverages in the presence of the tax on sugary beverages.

Table B3 in Appendix B presents these results. Overall, we do not see evidence for an increase in purchases of untaxed beverages. These results are in line with the findings of Seiler et al. (2021), Allcott et al. (2019*a*) and Powell et al. (2020*a*). This lack of evidence for substitution to untaxed beverages could be driven by a total reduction in beverage purchases. It could also be driven by substitution to non-store purchases (e.g., restaurants, vending machines) or consumption of non-purchased beverages (e.g., water at home), both of which are unobserved in the data.

3.2 Sub-categories of Taxed Beverages

To understand which sub-category of beverages is likely driving this effect, we further examine individual categories: sodas, diet sodas and all other drinks comprising Juice Drinks, Coffee and Tea Drinks and Cocktail Mixes. Table 2 presents these results. For sodas, purchase volume declined by 1.66 oz (equivalent to 4% of the pre-tax base purchase volume, not statistically significant) and 11.85 oz (equivalent to 27% of the pre-tax base purchase volume) in the two phases during the tax. For diet sodas these numbers are 12.54 oz (30%) and 10.1 oz (24%) respectively. For all other taxed beverages these numbers are 8.15 oz (27%) and 7.23 oz (23.5%) respectively. After the tax, purchase volume reverts to the pre-tax levels, as can be seen in Figure 7.

Our results show a more pronounced effect, magnitude-wise, from Diet Sodas relative to Sodas. From a health standpoint, it is unclear if Diet Sodas are as harmful as sugar sweetened sodas. Most studies have linked SSBs (and not ASBs) to adverse health outcomes. Nonetheless, sugar substitutes have recently come under scrutiny after the WHO released its report on aspartame, a non-sugar sweetener used in diet sodas (WHO, 2023). In either case, our results provide relevant input to policy makers when deciding whether artificially sweetened beverages should be included in such taxes.

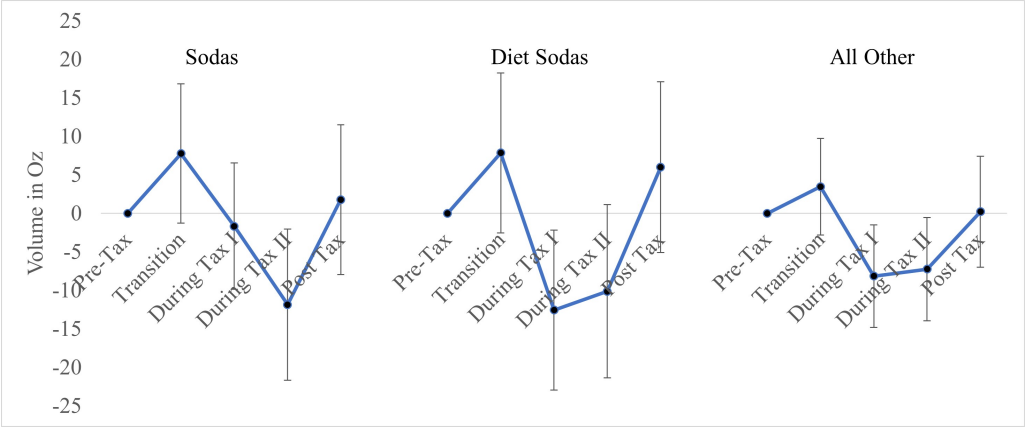


Figure 7: Change in Purchase Volume by Sub-categories of Taxed Beverages

Table 2: D-D-D Estimates by subcategories of Taxed Beverages

	(a)	(b)
	Without PI	With PI
Sodas		
2017 X Cook X Transition	7.77*	9.08*
	(4.62)	(4.68)
2017 X Cook X During Tax I	-1.66	2.58
	(4.19)	(4.4)
2017 X Cook X During Tax II	-11.85**	-3.64
	(5.01)	(5.43)
2017 X Cook X Post-Tax	1.78	3.8
	(4.97)	(5.05)
Pre-Tax Cook Mean (oz)	44.33	
N Observations	133,266	
N households	1,938	
Diet Sodas		
2017 X Cook X Transition	7.86	8.7
	(5.3)	(5.32)
2017 X Cook X During Tax I	-12.54**	-8.82*
	(5.3)	(5.15)
2017 X Cook X During Tax II	-10.1*	-4.97
	(5.74)	(5.76)
2017 X Cook X Post-Tax	6.02	7.24
	(5.65)	(5.63)
Pre-Tax Cook Mean (oz)	41.61	
N Observations	103,656	
N households	1,584	
All Other Taxed Beverages		
2017 X Cook X Transition	3.49	3.47
	(3.2)	(3.19)
2017 X Cook X During Tax I	-8.15**	-8.23**
	(3.4)	(3.4)
2017 X Cook X During Tax II	-7.23**	-7.5**
	(3.42)	(3.42)
2017 X Cook X Post-Tax	0.23	-0.05
	(3.68)	(3.7)
Pre-Tax Cook Mean (oz)	30.74	
N Observations	145,404	
N households	2,073	
Controls	2016 + Adj. Counties	
Fixed Effect	Household	
Clustering Level	Household	

*p<0.1; **p<0.05; ***p<0.01

Notes: The dependent variable is volume of beverage purchased in oz. All Other Taxed Beverages include Juice Drinks, Coffee and Tea Drinks and Cocktail Mixes. The duration of the Post Tax period is 9 weeks after the termination of the SSB. Column (a) presents results without controlling for prices, Column (b) controls for county-level price indices.

3.3 Heterogeneity

In this section we investigate the implications of the SSB tax on households with medical conditions, specifically obesity and diabetes, using the Nielsen Ailment Survey data. Our analysis includes only households that participated in the Nielsen Ailment Survey in 2016 or 2017. About 50% of households in our sample completed this survey.

3.3.1 Obesity and Diabetes

Approximately 20% of the households in our sample have at least one member of the household who suffers from diabetes. We interact this indicator (households with diabetes or not) with our coefficients in Equation 1 to examine if households with diabetes respond differently.

Table 3 presents the results of the analysis. First, looking at the transition period, we see that households without a diabetic member exhibit an increase in purchases of 21.9 oz (consistent with stockpiling behavior similar to that documented in Section 3.1). However, households with a diabetic member, do not exhibit such a pattern and we see purchases significantly decreasing in the transition period. This result favors the argument that the announcement of the tax serves as a negative signal wherein the taxed beverages are now classified as sin goods for this segment.

Second, we find that while the tax led to a significant decrease in the volume of taxed beverages purchased by households without a diabetic member, the decrease was even greater (an additional 40.09 oz during Tax I and an additional 50.84 oz during Tax II, equivalent to a 36% and a 46% decline respectively of pre-tax mean consumption levels) for households with at least one diabetic member. A rough estimate of the total decline in purchases of taxed beverages is approximately 16 oz for households without a diabetic member and an additional 166 oz for households with a diabetic member.

Third and more importantly, the decline was sustained for diabetic households - with the post-tax levels not reverting to pre-tax levels for diabetic households. After the tax is terminated, the purchase volume increases for households without diabetes by 2.44 oz

(not significant). However, the additional volume declines by 31.76 oz (statistically indistinguishable from the baseline) in the short 9 week period. However, when considering the longer 16-week post-tax window, we see a significant decline in purchases only for diabetic households: an additional 39.96 oz decline relative to the pre-tax baseline.

Our results are promising for policy makers where we do not see an increase in purchases during the transition period, and in fact see a decline in purchases during this period, suggesting the tax provides the right signal to this susceptible population. Moreover, we see a sustained decline in purchases even after the tax is lifted.

We do not find any significant differences between households with obesity vs not (Table C1 in the Appendix C).

Table 3: Estimates: Households With Diabetes

	(a)		(b)	
	Shorter Post-tax		Longer Post-tax	
	Without PI	With PI	Without PI	With PI
All Taxed Beverages				
2017 X Cook X Transition	21.9**	22.97**	20.98**	21.62**
	(10.06)	(10.09)	(9.95)	(9.98)
2017 X Cook X During Tax I	-18.02*	-14.85	-17.71*	-15.96
	(10.24)	(10.22)	(10.14)	(10.11)
2017 X Cook X During Tax II	-21.77*	-15.38	-21.28*	-17.86
	(11.16)	(11.25)	(11.05)	(11.14)
2017 X Cook X Post-Tax	2.44	3.7	2.19	2.37
	(10.17)	(10.19)	(9.72)	(9.74)
2017 X Cook X Transition X Diabetes	**-44.16***	**-43.95***	**-43.08***	**-43.07***
	(23.05)	(23.08)	(22.82)	(22.83)
2017 X Cook X During Tax I X Diabetes	**-40.09***	**-39.76***	**-39.96***	**-39.9***
	(21.96)	(21.96)	(21.83)	(21.82)
2017 X Cook X During Tax II X Diabetes	**-50.84****	**-50.91****	**-50.91****	**-51.08****
	(23.47)	(23.38)	(23.3)	(23.25)
2017 X Cook X Post-Tax X Diabetes	**-31.76**	**-32.58**	**-38.96***	**-39.64***
	(22.03)	(21.98)	(21.37)	(21.36)
Pre-Tax Cook Mean (oz)	90.62		89.21	
Pre-Tax Cook Mean (oz) (HH with Diabetes)	110.38		109.25	
N Observations	82,110		96,677	
N households	1,073		1,076	
Controls	2016 + Adj. Counties			
Fixed Effect	Household			
Clustering Level	Household			

*p<0.1; **p<0.05; ***p<0.01

Notes: The dependent variable is volume of beverage purchased in oz. All Taxed Beverages include all SSBs and Diet Soda. Pre-Tax refers to the 9 weeks before the transition period. During Tax I refers to the period during the tax before the announcement of the tax termination, while During Tax II refers to the period after the announcement. The duration of the Post Tax period is 9 weeks in Column (a) and 16 weeks in Column (b). Clustered standard errors in parentheses.

4 Price Changes in Response to the Tax

In this section we evaluate whether prices changed in the three main periods of interest. We estimate the same D-D-D specification as before, with the previous year (2016) and adjacent

counties as controls, but with price per oz as the dependent variable.

Table 4 presents the coefficient estimates for the impact of the SSB tax on beverage prices, focusing on the top 50 best-selling beverages, which account for approximately 37% of total beverage sales. Our estimates show that prices during the tax are higher. The prices of all taxed beverages are 0.18 cents higher during the tax. The coefficient estimates for SSBs (all taxed beverages except Diet Soda) are similar, reflecting an approximate increase of 0.15 cents per oz during the tax.

Overall, our findings highlight that the implementation of the SSB tax was accompanied by an increase in beverage prices, potentially making sugary drinks less affordable. One reason for such an increase could be that retailers or manufacturers, knowing that prices paid by consumers are going to increase because of the tax, increase the list price as well. These results are consistent with Powell et al. (2020*b*) who, using store-level price data from NielsenIQ, find a price per oz increase of 0.21 cents across all taxed beverages.[4,5]

Nonetheless, these results show the importance of controlling for prices, via a price index, in our estimation of purchase volume changes due to the tax. Even accounting for the price increase, we see a similar effect of the tax on purchase behavior (Table 1).

[4]They include the additional 1 cent per oz tax in their analysis, leading to a 1.21 cent increase; but for our purposes the additional increase in list prices amounts to 0.21 cents. Note the taxed amount was available to the shopper only at checkout as a line-item in their receipt, and the tax was not passed-through unlike most soda taxes.

[5]We also replicate our price analysis using the NielsenIQ RMS data and find a similar increase in prices, amounting to 19 cents across all taxed beverages.

Table 4: Change in Prices for the Top 50 UPCs

	coeff
All Taxed Beverages	
2017 X Cook X Transition	-0.0451
	(0.0777)
2017 X Cook X During Tax I	0.1764**
	(0.0839)
2017 X Cook X During Tax II	0.1306
	(0.0807)
2017 X Cook X Post-Tax	-0.0019
	(0.0677)
N Observations	6,537
N UPC	50
SSBs	
2017 X Cook X Transition	-0.069
	(0.0687)
2017 X Cook X During Tax I	0.1481*
	(0.0747)
2017 X Cook X During Tax II	0.14
	(0.0871)
2017 X Cook X Post-Tax	-0.0709
	(0.0703)
N Observations	5,929
N UPC	50
Controls	2016, Adj. Counties
Fixed Effect	UPC
Clustering Level	UPC

Notes: The dependent variable is price per oz of the beverage in USD. All Taxed Beverages include the top 50 UPCs across all SSBs and Diet Soda. SSBs include the top 50 UPCs across all sugar-sweetened beverages but not Diet Soda. The baseline pre-Tax consists of the 9 weeks before the transition period. The duration of the Post Tax period is 9 weeks after the termination of the SSB tax.

5 Conclusion

This paper investigates whether soda taxes can have lasting changes on consumers' purchase behavior, or primarily work as a price deterrent. Three main behaviors can emerge from a tax policy: the tax as a whole deters purchases, either via price directly or through a signalling mechanism that the taxed good is a "sin" good; the tax encourages sustained healthy consumption leading to fewer SSBs purchased, a behavior which if learnt can last even in the absence of the tax; taxed prices appear psychologically more creating a loss aversion, a behavior which if true can lead to adverse outcomes when the tax is lifted.

Using a natural experiment where a tax was not only implemented, but lifted soon after, we find that in the absence of the tax behavior reverts to pre-tax levels overall. However, for more susceptible populations, we find evidence of sustained healthy purchase behavior: specifically, for households with at least one diabetic member we find purchases drop starkly during the tax but do not return to pre-tax levels after the tax is lifted. From a policy makers standpoint, such sustained behavior is promising in improving individuals' health outcomes.

This paper cannot comment on beverage purchases or consumption outside the store setting (e.g., at restaurants, tap water at home), which is a limitation we acknowledge. Nonetheless, by observing purchases at the individual household level, we can focus on the household as a unit of analysis observing their complete purchase pattern. As a result, we do not have rely on assumptions of substitution patterns that are often required when using store-level sales data or cross-sectional survey data.

This paper examines the overall effect of the policy and its reversal on households. Our approach of examining total beverage consumption of the household using the natural experiment helps address our research question and enables us to comment on the healh policy implications of such policies. However, we acknowledge there are multiple questions that could be of interest to future researchers. For example, understanding changes in price sensitivity due to the tax, as well as differential changes in price sensitivity during the tax and after the tax was lifted, which would require estimating a household-level choice model,

would be interesting questions to explore.

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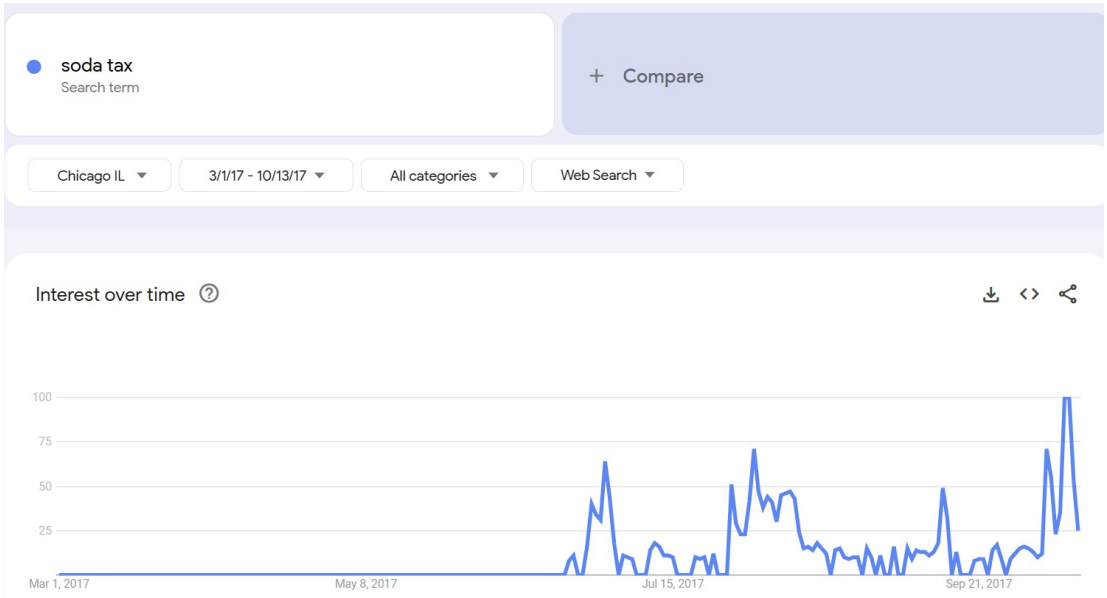
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Appendix

A Google Search Volume



Notes: Figure presents the Google Search Volume for the term Soda Tax in Chicago, IL. The tax went into effect on August 2, 2017. Interest via google searches appear to start aroun June 2017.

Figure A1: Google Search Volume in Chicago for term "Soda Tax"

B Robustness Checks

Table B1: D-D-D Estimates: Robustness Checks

	(a)		(b)		(c)	
	Original Estimates		Longer Post-Tax		Milwaukee Control	
	Without PI	With PI	Without PI	With PI	Without PI	With PI
All Taxed Beverages						
2017 X Cook X Transition	14.71**	15.9**	13.91**	14.56**	8.15	4.09
	(6.15)	(6.18)	(5.95)	(5.97)	(10.76)	(10.77)
2017 X Cook X During Tax I	-15.81***	-12.29**	-15.31***	-13.5**	-16.92	-13.56
	(6.08)	(6.12)	(5.89)	(5.91)	(10.94)	(11.01)
2017 X Cook X During Tax II	-21.42***	-14.61**	-20.8***	-17.34***	-18.71*	-12.18
	(6.55)	(6.76)	(6.34)	(6.52)	(11.28)	(11.48)
2017 X Cook X Post-Tax	5.86	7.25	1.82	1.98	5.71	7.32
	(6.83)	(6.86)	(6.84)	(6.84)	(12.15)	(12.17)
Pre-Tax Cook Mean (oz)	88.42		86.03		88.05	
N Observations	165,858		199,675		106,176	
N households	2,249		2,288		1,446	
SSBs						
2017 X Cook X Transition	9.71*	10.68**	9.24*	9.66**	-2.15	-5.05
	(5.05)	(5.08)	(4.88)	(4.89)	(8.03)	(8.04)
2017 X Cook X During Tax I	-8.5*	-5.59	-8.16*	-6.92	-24.11***	-20.87***
	(4.94)	(5.06)	(4.77)	(4.86)	(7.44)	(7.54)
2017 X Cook X During Tax II	-16.13***	-10.02*	-15.35***	-12.72**	-14.64*	-8.31
	(5.48)	(5.69)	(5.29)	(5.47)	(8.37)	(8.65)
2017 X Cook X Post-Tax	1.92	3.93	0.76	1.2	-6.17	-4.02
	(5.73)	(5.79)	(5.75)	(5.76)	(8.28)	(8.36)
Pre-Tax Cook Mean (oz)	64.53		62.36		64.56	
N Observations	161,196		194,677		102,312	
N households	2,216		2,257		1,410	
Controls	2016 + Adj. Counties		2016 + Adj. Counties		2016 + Milwaukee	
Fixed Effect	Household					
Clustering Level	Household					

*p<0.1; **p<0.05; ***p<0.01

Notes: The dependent variable is volume of beverage purchased in oz. All Taxed Beverages include all SSBs and Diet Soda. SSBs include all sugar-sweetened beverages but not Diet Soda. All estimates are relative to the baseline Pre-Tax period consisting of the 9 weeks before the transition period. Column (a) presents the original estimates from Table 1. Column (b) presents estimates using a longer post-tax period of 16 weeks. Column (c) presents estimates using Milwaukee as a control.

Table B2: D-D-D Estimates: Robustness Check using Household PI

	(a)	(b)
	Original Estimates	Household Price Index
All Taxed Beverages		
2017 X Cook X Transition	15.9**	15.83**
	(6.18)	(6.18)
2017 X Cook X During Tax I	-12.29**	-12.32**
	(6.12)	(6.12)
2017 X Cook X During Tax II	-14.61**	-14.66**
	(6.76)	(6.75)
2017 X Cook X Post-Tax	7.25	7.24
	(6.86)	(6.86)
Pre-Tax Cook Mean (oz)	88.42	
N Observations	165,858	
N households	2,249	
SSBs		
2017 X Cook X Transition	10.68**	10.62**
	(5.08)	(5.08)
2017 X Cook X During Tax I	-5.59	-5.6
	(5.06)	(5.05)
2017 X Cook X During Tax II	-10.02*	-10.04*
	(5.69)	(5.68)
2017 X Cook X Post-Tax	3.93	3.93
	(5.79)	(5.79)
Pre-Tax Cook Mean (oz)	64.53	
N Observations	161,196	
N households	2,216	
Controls	2016 + Adj. Counties	
Fixed Effect	Household	
Clustering Level	Household	

*p<0.1; **p<0.05; ***p<0.01

Notes: The dependent variable is volume of beverage purchased in oz. All Taxed Beverages include all SSBs and Diet Soda. SSBs include all sugar-sweetened beverages but not Diet Soda. All estimates are relative to the baseline Pre-Tax period consisting of the 9 weeks before the transition period. Column (a) presents the original estimates, Table 1 Column (b) with county-level PI controls. Column (b) presents estimates using household-specific price indices.

Table B3: D-D-D Estimates: Untaxed Beverages

	(a)	(b)
	Without PI	With PI
Untaxed Beverages		
2017 X Cook X Transition	-5.64	-4.97
	(7.08)	(7.05)
2017 X Cook X During Tax I	-1.72	1.09
	(7.19)	(7.21)
2017 X Cook X During Tax II	-7.84	-7.8
	(8.11)	(8.1)
2017 X Cook X Post-Tax	3.1	4.86
	(7.73)	(7.72)
Pre-Tax Cook Mean (oz)	64.78	
N Observations	143,262	
N households	2,039	
Controls	2016 + Adj. Counties	
Fixed Effect	Household	
Clustering Level	Household	

*p<0.1; **p<0.05; ***p<0.01 Notes: The dependent variable is volume of beverage purchased in oz. Untaxed Beverages include water, sparkling water and untaxed juices. All estimates are relative to the baseline Pre-Tax period consisting of the 9 weeks before the transition period. The duration of the Post Tax period is 9 weeks after the termination of the SSB tax. Clustered standard errors in parentheses.

C Heterogeneity: Households with Obesity

Table C1: Estimates: Households With Obesity

	(a)		(b)	
	Shorter Post-tax		Longer Post-tax	
	Without PI	With PI	Without PI	With PI
All Taxed Beverages				
2017 X Cook X Transition	19.37*	20.53**	18.47*	19.12*
	(10.42)	(10.46)	(10.3)	(10.32)
2017 X Cook X During Tax I	-24.98**	-21.65**	-24.64**	-22.85**
	(10.24)	(10.19)	(10.13)	(10.08)
2017 X Cook X During Tax II	-29.57***	-23.13**	-29.08***	-25.68**
	(11.2)	(11.29)	(11.08)	(11.18)
2017 X Cook X Post-Tax	-4.41	-3.13	-4.92	-4.81
	(10.3)	(10.31)	(9.92)	(9.93)
2017 X Cook X Transition X Obesity	**-23.26**	**-23.51**	**-22.55**	**-22.6**
	(21.42)	(21.44)	(21.27)	(21.29)
2017 X Cook X During Tax I X Obesity	**-2.81**	**-3.28**	**-2.9**	**-3.05**
	(22.1)	(22.13)	(21.95)	(21.97)
2017 X Cook X During Tax II X Obesity	**-8.44**	**-8.76**	**-8.42**	**-8.57**
	(23.7)	(23.69)	(23.52)	(23.52)
2017 X Cook X Post-Tax X Obesity	**3.44**	**2.68**	**-1.7**	**-1.94**
	(21.65)	(21.69)	(20.66)	(20.71)
Pre-Tax Cook Mean (oz)	90.62		89.21	
Pre-Tax Cook Mean (oz) (with Obesity)	101.11		100.26	
N Observations	82,110		96,677	
N households	1,073		1,076	
Controls	2016 + Adj. Counties			
Fixed Effect	Household			
Clustering Level	Household			

*p<0.1; **p<0.05; ***p<0.01 Notes: The dependent variable is volume of beverage purchased in oz. All Taxed Beverages include all SSBs and Diet Soda. Pre-Tax refers to the 9 weeks before the transition period. The duration of the Post Tax period is 9 weeks in Column (a) and 16 weeks in Column (b). Clustered standard errors in parentheses.