Cornell University

Taxes on Sugar-Sweetened Beverages:
Impacts on Prices, Purchases, and Consumption

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Outline

- Introduction to, and motivation for, taxes on sugar-sweetened beverages (SSBs)
- Data and methods (will discuss strengths and limitations of different types) for estimating the effect of SSB taxes in:
  - Berkeley, CA
  - Boulder, CO
  - **Philadelphia, PA**
  - **Oakland, CA**
  - San Francisco, CA
  - Seattle, WA
- Results regarding impact of SSB taxes on:
 - Prices
  - Purchases
  - Consumption

Public Health Motivation:
Rise in Diet-Related Chronic Disease

- Prevalence of obesity:
  - Worldwide: 1975-2004, rose from:
    - 3.2% to 10.8% among men (NCD Risk Factor Collaboration, 2016)
    - 6.4% to 14.9% among women (NCD Risk Factor Collaboration, 2016)
    - OW & OB #5 risk factor for preventable death, responsible for 2.8 million deaths annually (WHO, 2009)
  - U.S.: 1976-80 to 2017-18, rose from:
    - 15.1% to 42.4% (NCHS, 2014, 2017; Hales et al., 2020)

Rise in Diet-Related Chronic Disease

- Prevalence of diabetes:
  - Worldwide: 1980-2014, rose from:
    - 4.3% to 9.0% among men (NCD Risk Factor Collaboration, 2016)
    - 5.0% to 7.9% among women (NCD Risk Factor Collaboration, 2016)
    - Diabetes #3 risk factor for preventable death, responsible for 3.4 million deaths annually (WHO, 2009)
  - U.S.: 1980-2017, rose from:
    - 2.54% to 7.40% (CDC, 2017)

Number and Percentage of U.S. Population with Diagnosed Diabetes, 1958-2015
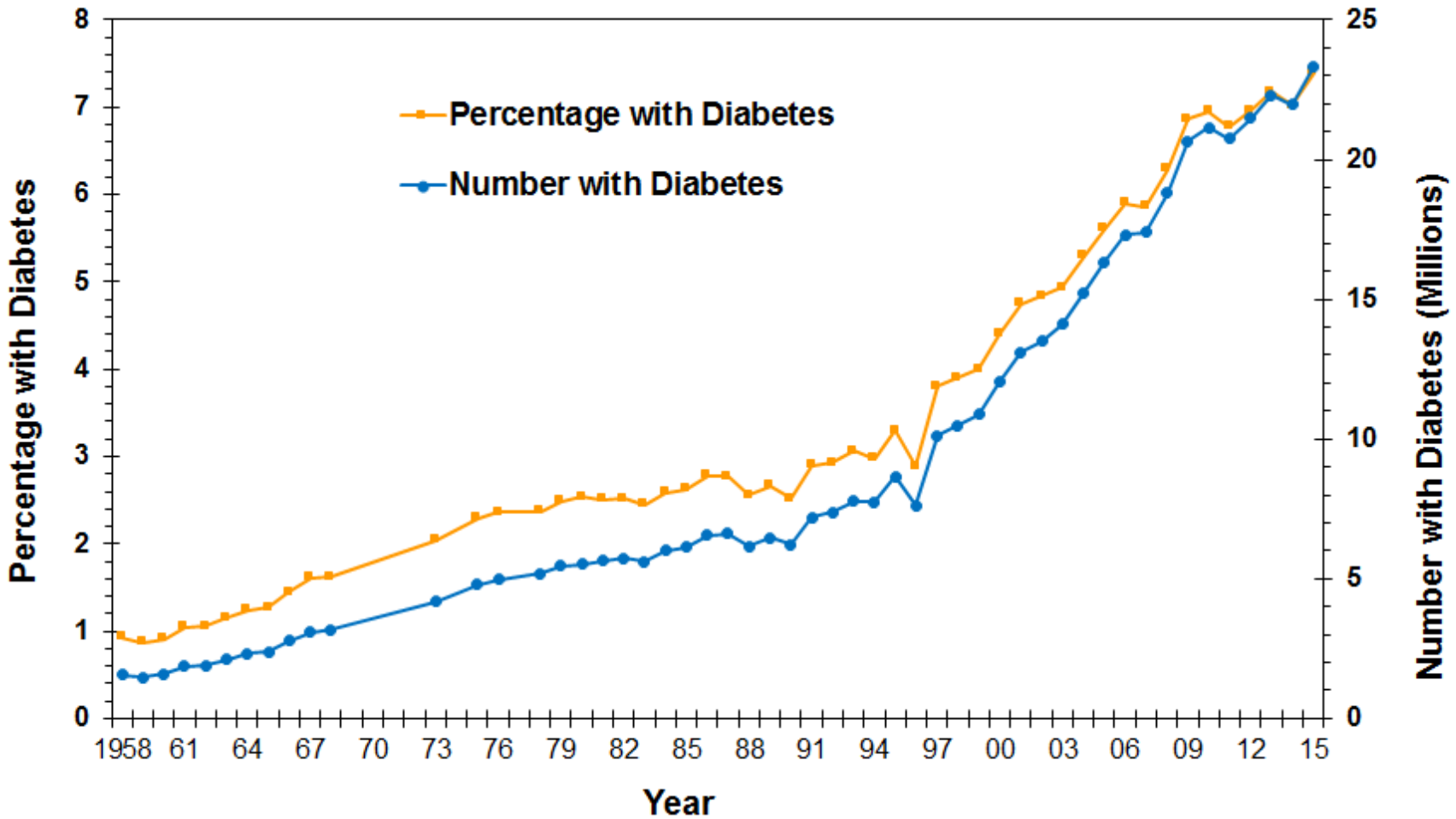
CDC's Division of Diabetes Translation. United States Diabetes Surveillance System available at http://www.cdc.gov/diabetes/data

Economic Motivation

- Obesity and diabetes are expensive to the U.S. health care system:
  - Medical care costs of obesity in 2016: $260.6 billion (Cawley, Biener, Meyerhoefer, et al. 2021)
  - Medical care costs of diabetes in 2017: $237 billion (ADA, 2020)
- Impose negative externalities through health insurance system
  - 88% of obesity-related medical costs paid by third-party payers (Cawley and Meyerhoefer, 2012)
  - 67.3% of diabetes care paid by government insurance (e.g. Medicare, Medicaid) and 30.7% by private insurance
- Negative externalities (as a market failure) generally seen as an economic rationale for government intervention
- Behavioral economics also sees "internalities" as economic rationale: people may fail to maximize own utility due to (e.g.) time-inconsistent preferences (Allcott et al., 2019)
- One possible way to address externalities and internalities: tax energy-dense foods such as SSBs

"**Sugar**, rum, and tobacco are commodities which are nowhere necessaries of life, which are become objects of almost universal consumption, and which are therefore extremely proper subjects of **taxation**." – Adam Smith, Wealth of Nations, 1776, Book V, Chapter III

1917-19: US wartime tax on soda

to generate revenue

Role of Sugar-Sweetened Beverages (SSBs) in Obesity and Diabetes

- Arguments by public health advocates:
  - SSBs have calories but no nutrients
  - SSBs, as liquids, may not invoke satiety – do not lead to offsetting decrease in other calorie consumption
  - Independent of calories, may raise glycemic load or cause insulin spikes, raising risk of diabetes (Hill et al.; Malik & Hu, 2011)
  - Pragmatically, SSBs are easy target
- Industry counter-arguments:
  - Why should SSBs be singled out when many foods/drinks have calories and few/no nutrients?
  - Consumption of SSBs has fallen dramatically in past 15 years but obesity and diabetes have continued to rise
    - 2003-2014, calorie intake from SSBs fell 41% for children and 26.3% for adults Bleich et al. (2018)

Consumers Drinking Less Carbonated Soft Drinks (CSD)

The Shifting Beverage Landscape

Carbonated soft drink volume declined for the 13th consecutive year in 2017 and more declines are likely to come in the years ahead

- Today's consumers are migrating to healthier options and want more variety

U.S. Carbonated Soft Drink Market
Billions of Gallons
2012 – 2017P

	2012	2013	2014	2015	2016	2017P
	13.3	12.9	12.8	12.6	12.5	12.3
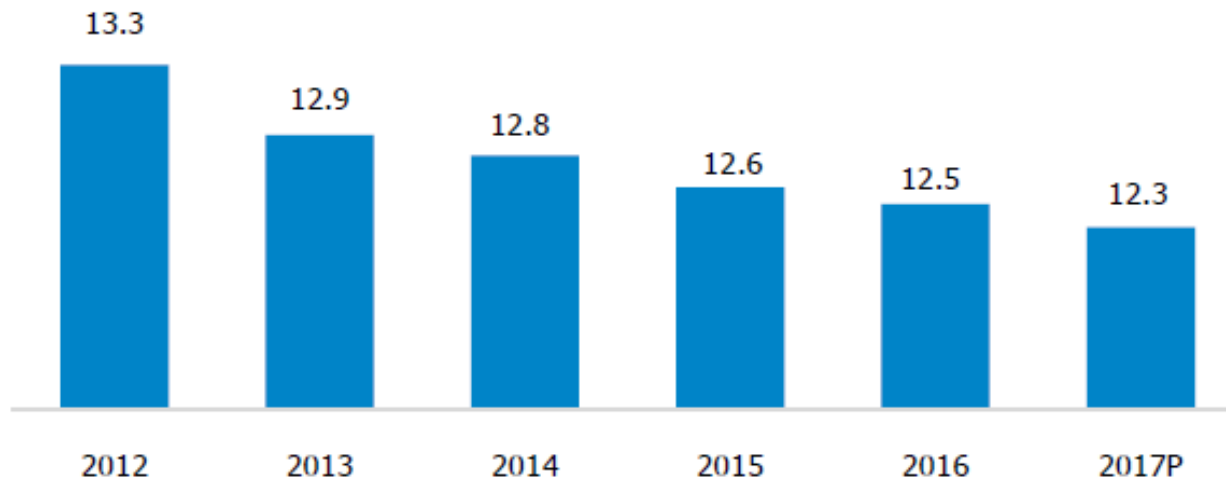
YEAR	2012/13	2013/14	2014/15	2015/16	2016/17P	12/17P CAGR
Change	-3.2%	-1.0%	-1.5%	-0.8%	-1.2%	-1.5%

P: Preliminary
Source: Beverage Marketing Corporation

BEVERAGE MARKETING CORPORATION

Taxes on Sugary Drinks

- Numerous medical & public health organizations have endorsed/recommended taxes on SSBs as a way of preventing/reducing obesity and diabetes:
  - Society of Behavioral Medicine (2019)
  - American Academy of Pediatrics & American Heart Association (2019)
  - WHO (2016)
  - British Medical Association (2015)
  - APHA (2012)

World Health Organization

Taxes on sugary drinks: Why do it?

Sugary drink taxes around the world

Europe:
Norway
Finland
Latvia
United Kingdom
Ireland
Belgium
France
Hungary
Spain (Catalonia)
Portugal
Morocco
St Helena

Western Pacific:
Philippines
Brunei
Cook Islands
Fiji
Palau
French Polynesia
Kiribati
Nauru
Samoa
Tonga
Vanuatu

Americas:
USA (8 local)
Bermuda
Mexico
Dominica
Barbados
Panama
Peru
Chile

Africa, Eastern Mediterranean and Southeast Asia:
Saudi Arabia
Bahrain
Qatar
United Arab Emirates
Oman
India
Sri Lanka
Thailand
Malaysia
Maldives
Seychelles
Mauritius
South Africa

Updated December 2, 2019

Taxes on SSBs in the U.S.

Seattle

Albany
Berkeley
Bay Area
San Francisco
Oakland

Cook County
Philadelphia

Boulder

Navajo Nation

Implemented

Enacted

Repealed

Tax rates:
1.0 cents/oz (Berkeley, Albany, Oakland, SF)
1.5 cents/oz (Philadelphia)
1.75 cents/oz (Seattle)
2.0 cents/oz (Boulder)
2% extra sales tax on soda and junk food (Navajo Nation)

Washington, DC, considering a 1.5 cent/oz SSB tax

SSB Taxes Highly Controversial

- Caputo and Lusk (2020): in 2019 survey in U.S., 68% say would vote against soda tax that raised prices by 25%
- Millions of dollars spent on anti-tax ads by American Beverage Assn and on pro-tax ads by Bloomberg Foundation
- SSB taxes failed to pass in:
  - 2010: New York State
  - 2012: Richmond, CA; El Monte, CA
  - 2013: Telluride, CO
  - 2014: San Francisco, CA (2 cents/oz); tax of 1 cent/oz later passed in 2016
  - 2017: Santa Fe, NM
- SSB tax repealed in Cook County, IL, after 2 months (2017)
- States that have banned cities from taxing SSBs:
  - 2017: MI
  - 2018: AZ, CA, WA

SODA TAX STILL STIRS UP FOES

Drug Store Runs Out of Blanks When Patrons Flock to Sign Protest.

MORE OPINIONS ON TAP

Measure Is Called Obnoxious, an Outrage, and Various Other Mean Names.

Indianapolis Star, July 12, 1919, p. 9

Country-Wide Protest Against Soda Tax

Protest in NYC's Central Park, 1919   Source: Austin American, June 5, 1919, p. 1.

Philadelphia, 2016

Our Research Agenda / Contributions

- Research question: **what is the impact of city-level SSB taxes on the prices, purchases and consumption of the taxed beverages**?

- Study impact on SSB <u>prices</u> in three types of data:
  - Hand-collected data from store audits in Berkeley, Boulder, Oakland, Philadelphia
  - Web-scraped data from restaurants in Boulder
  - Scanner data from stores in Boulder
- Study impact on consumer <u>purchases</u> using two types of data:
  - Original survey data in Philadelphia, Oakland
  - Scanner data on customer purchases in Philadelphia, Oakland, Seattle & San Francisco
- Study impact on <u>consumption</u>
  - Longitudinal survey data in Philadelphia, Oakland
    - First longitudinal survey data for adults
    - First survey data of any kind for children

Effect on Prices / Pass-Through of Tax

- All of the city-level SSB taxes in the U.S. are levied on beverage distributors who sell to stores
- Micro theory predicts that effect of tax on retail prices depends on relative elasticities of supply and demand (e.g. Kotlikoff & Summers, 1987)
  - Whom tax is levied on is irrelevant
  - If demand perfectly inelastic, prices rise by 100% of tax
  - If demand perfectly elastic, prices don't rise at all
    - Coke absorbed all of WW1 soda tax – did not raise prices
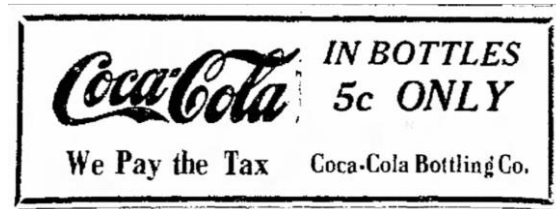
  - Elasticity of S&D may vary across city, so pass-through may vary as well

Studies of SSB Tax Pass-Through

- Methods: difference-in-differences
  - Minimum of 2 time periods: 1 before, and 1 after, implementation of SSB tax
  - Minimum of 2 geographic clusters: treated city and comparison area (suburbs or another nearby city)
    - Tradeoff in choosing comparison area: nearby area more likely to satisfy parallel trends assumption, but may experience spillover from tax (cross-border shopping)

- Data: tradeoff between number/breadth of stores, number of products observed, and number of time periods in which observe price
  - Audit data: hand-collected data from stores
  - Scanner data
  - Web-scraped data

- Summary of findings: generally less than full pass-through of tax
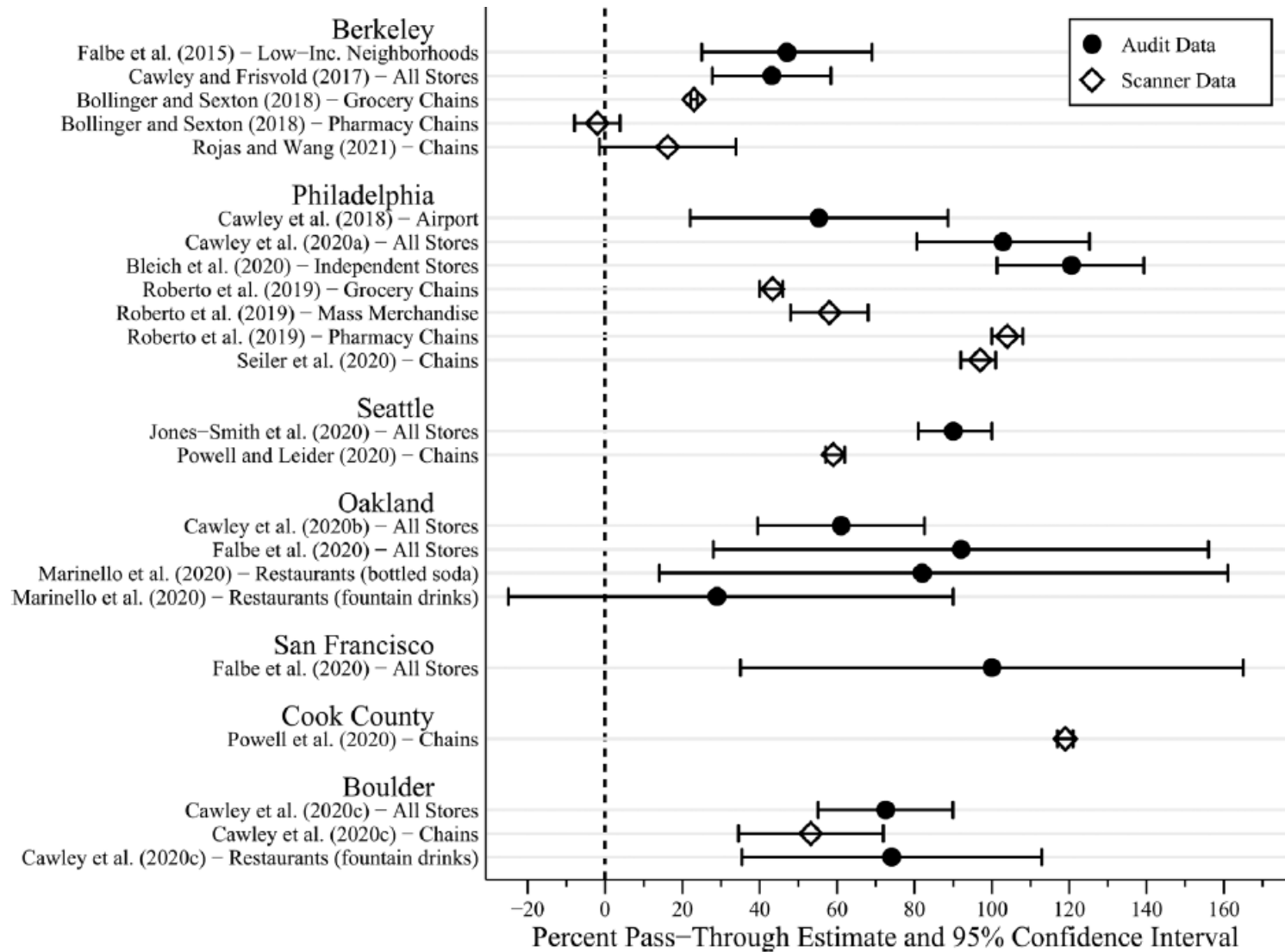
Figure 1. Estimated pass-through of SSB taxes, by city, study, and data type

Note: This figure shows the pass-through estimates with the 95% confidence interval for papers in the literature on SSB taxes, including the estimates from this paper. The pass-through estimates are calculated as the point estimate of the change in price, in cents per ounce, divided by the amount of the local tax. The figure shows the primary estimate for all stores or restaurants in the sample for all SSBs, if available; otherwise, the row headings describe the store types or beverage types corresponding to the estimate.

Cawley, Frisvold, Jones, Lensing *AJAE* (forthcoming 2021)

Philadelphia Intl. Airport

Terminals A-West and A-East, and a few gates in Terminal B, lie within Tinicum Township.

- - - Philadelphia-Tinicum border

Terminal F (not shown)

Terminal E

Terminal D

Terminal C

Terminal B

Terminal A-East

Terminal A-West

PHILADELPHIA

TINICUM TWP.

SOURCE: U.S. Geological Survey photo, May 2002

JOHN DUCHNESKIE / Inquirer Staff Artist

See Cawley, Willage, and Frisvold *JAMA* (2018)

Results
Cawley, Frisvold, Willage *JAMA*, (2018)

Table 1. Mean Price and Mean Change in Price of Sugar-Sweetened Beverages (SSBs) at the Tinicum Side (Untaxed) vs Philadelphia Side (Taxed) of the Philadelphia International Airport[a]

Time Point	Tinicum Side Price		Philadelphia Side Price		Difference in Mean Change (95% CI), ¢/oz
	Mean (95% CI), ¢/oz (n = 10 Stores)	Mean Change vs December 2016 (95% CI), ¢/oz	Mean (95% CI), ¢/oz (n = 21 Stores)	Mean Change vs December 2016 (95% CI), ¢/oz	
Before new tax on SSBs					
December 2016	12.37 (10.83-13.91)		12.53 (11.80-13.25)		
After new tax on SSBs					
January 2017	12.78 (11.07-14.48)	0.41 (−0.08 to 0.89)	13.44 (12.59-14.29)	0.91 (0.60 to 1.23)	0.51 (−0.01 to 1.03)
February 2017	12.93 (11.21-14.64)	0.56 (0.03 to 1.09)	13.92 (13.18-14.66)	1.39 (1.20 to 1.58)	0.83 (0.33 to 1.33)

[a] Standard errors are clustered at store location level.

- Diff-in-diff estimate: by February, tax increased prices by 0.83 cents/oz or by 55.3% of the tax
- However, some stores on Tinicum side raised prices by exactly amount of tax; suggests policy had spillover effects to "control" area
- If look at change in only taxed stores (Phila. alone), 93% of tax was passed on by February

How Large are the Resulting Price Increases?

**Philadelphia
(1.5 cents/oz)**

**Oakland
(1 cent/oz)**

$1.62   ⬆ 22% $1.98

$1.97   ⬆ 43% $2.82

$5.28   ⬆ 32% $6.95

$1.87   ⬆ 6% $1.98

$2.33   ⬆ 18% $2.74

$6.31   ⬆ 16% $7.30

Based on estimates in Cawley, Frisvold, Hill, and Jones (*JPAM* 2020, *EHB* 2020)

Mathematica

Two Sources of Data on Purchases

1. <u>Street intercept surveys of consumers</u>
   - Select representative set of stores based on store type and sales volume using ReferenceUSA in T and C areas
     - Match stores in T area with stores in C area with closest score based on (% African-American, % Hispanic, % HH in poverty), within type
     - Comparison areas: same MSA but outside taxing city
   - Conduct street intercept interviews outside of stores in taxing cities and control areas
     - Conducted on all days of week, at wide variety of times of day
     - Surveyed adults with at least one child in the HH
     - Consumers asked to show (receipts or actual) beverages they just purchased, or to report them
       - Record quantity, name and size of each beverage
     - Conducted before and after tax, 1 year apart
       - Philadelphia: Nov-Dec of 2016 and 2017
       - Oakland: Apr-June of 2017 and 2018
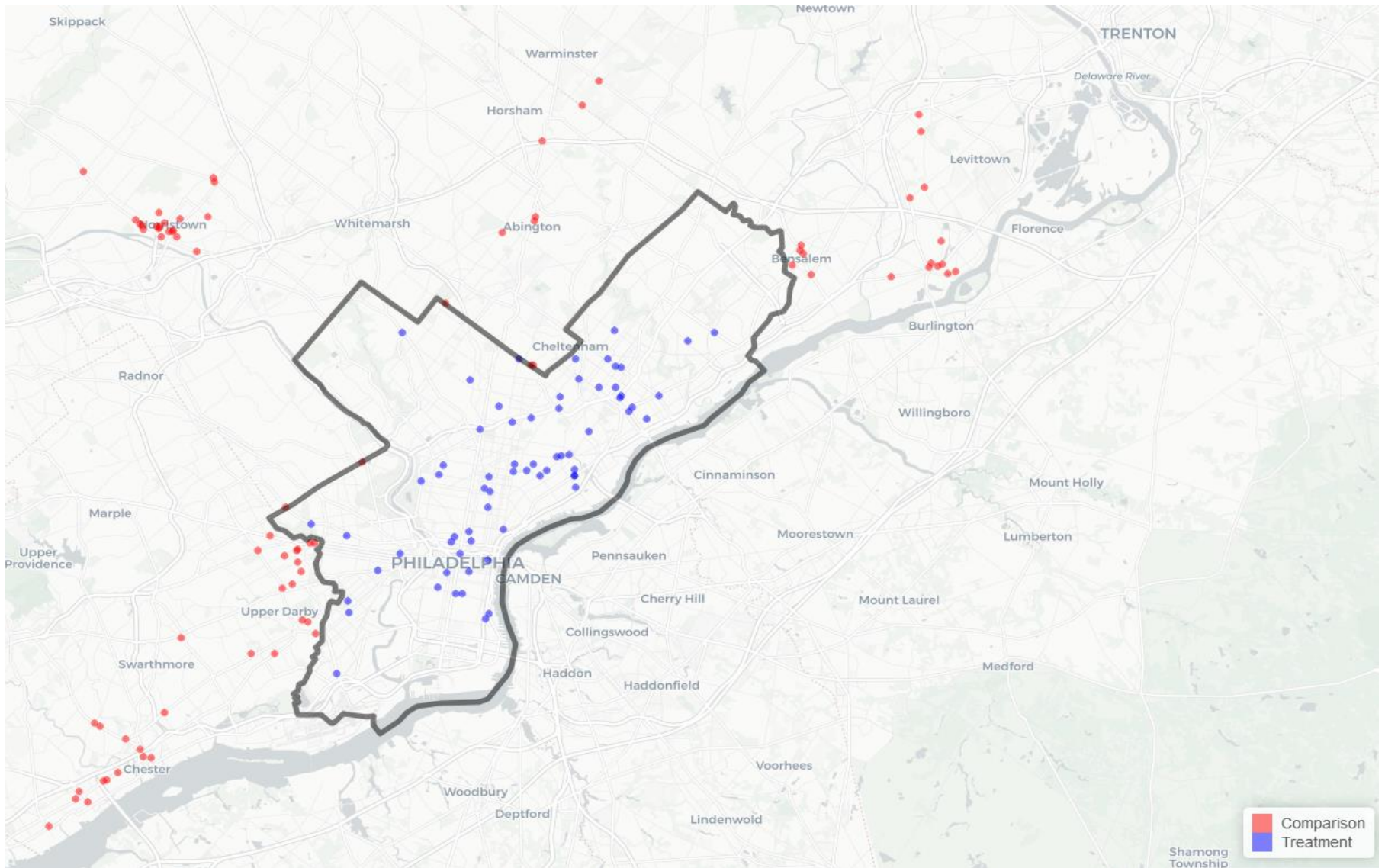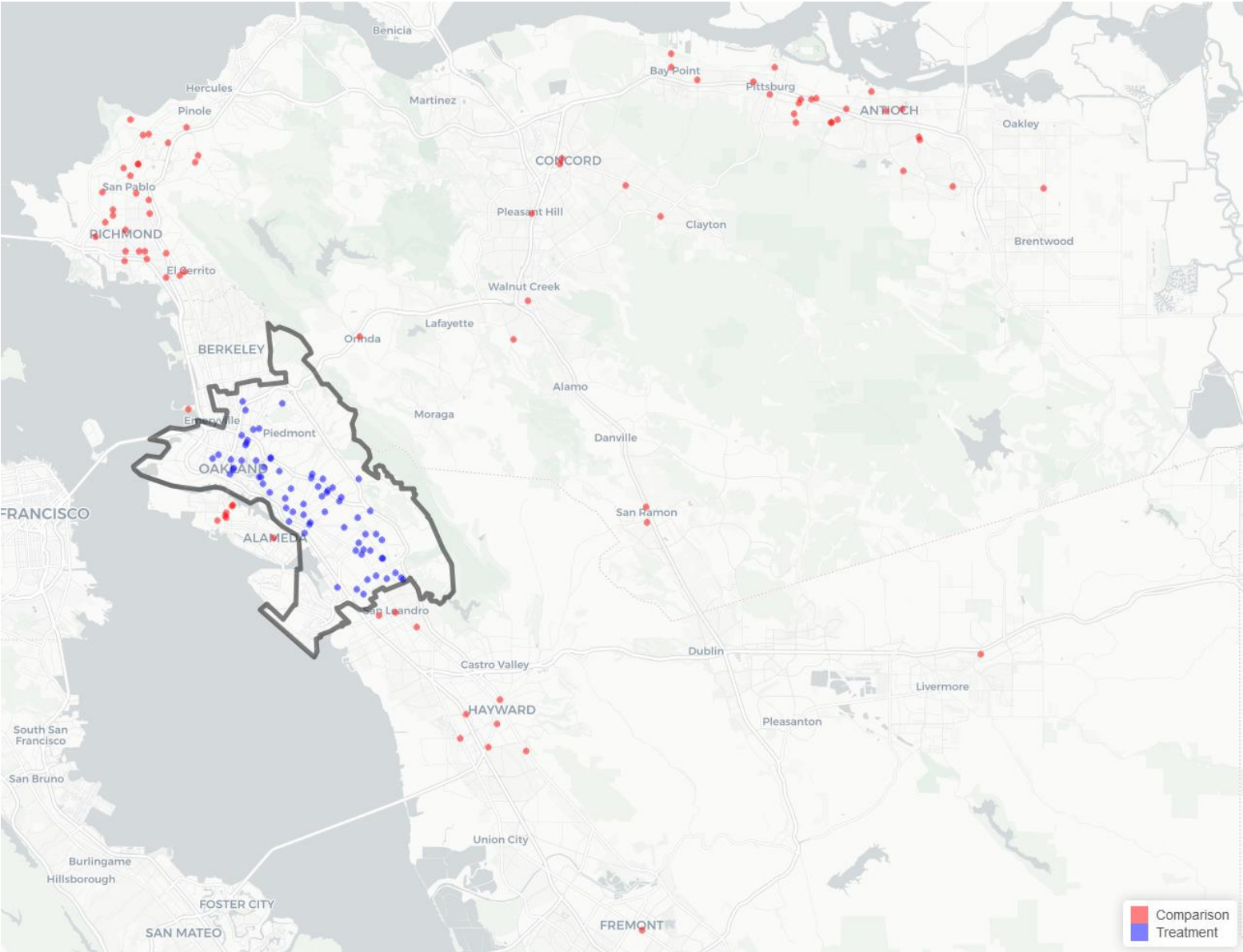
Street Intercept Surveys of Consumers

- Advantages:
  - Can learn about purchases from all types of stores: large supermarkets, convenience stores, pharmacies, gas stations, warehouse stores
    - Retail scanner data tends to be only large chains
  - Can determine where people travel from, study cross-border shopping

- Disadvantages:
  - May be unrepresentative sample
  - May be small sample
  - Limited # time periods
  - Time-intensive and expensive to collect
  - Repeat x-sectional data not longitudinal

Consumer Survey Data on Purchases

Total sample size (# interviews):

Oakland: N=3,078

Philadelphia: N=2,806

Table 2. Number of exit interviews and households surveys completed pre- and post- tax

	Respondents in cities		Respondents in comparison areas	
	Pre-tax	Post-tax	Pre-tax	Post-tax
Exit interviews				
Oakland	785	786	741	766
Philadelphia	600	763	705	738

Methods: Difference-in-Differences

$$Y_{it} = \alpha_0 + \alpha_1 Post_t + \alpha_2 Treated_i + \alpha_3 Treated_i * Post_t + \alpha_4 X_{it} + \varepsilon_{it} \,,$$

- Pool data from before and after tax, from both taxing (treated) city and control areas
- *Treated* defined based on location of store, not residence of consumer
- *X* includes: indicator variables for store type, age, gender, race/ethnicity, HH size, poverty, day of week, time of day
- α_3 is the DiD estimator, and is the estimate of the effect of the tax on *Y*
  - How did purchases change in the taxing city, relative to how it changed in the control city?

Methods: Difference-in-Differences (cont.)

$$Y_{it} = \alpha_0 + \alpha_1 Post_t + \alpha_2 Treated_i + \alpha_3 Treated_i * Post_t + \alpha_4 X_{it} + \varepsilon_{it} \, ,$$

- Cluster std errors at level of store (where individuals identified)
  - Limitation: cannot cluster by geographic unit (only 2)
  - As a result, standard errors likely underestimated
- Regressions weighted using survey weights at consumer level, which account for sample design, oversampling, and non-response
- Identifying assumption is that comparison area is a valid counterfactual for taxing city; i.e. that time trend *Post* is the same in both areas
  - "Parallel trends" assumption

Parallel Trends in Sales of Soda (Reg & Diet): Philadelphia vs Comparison Areas

Nielsen retail scanner data
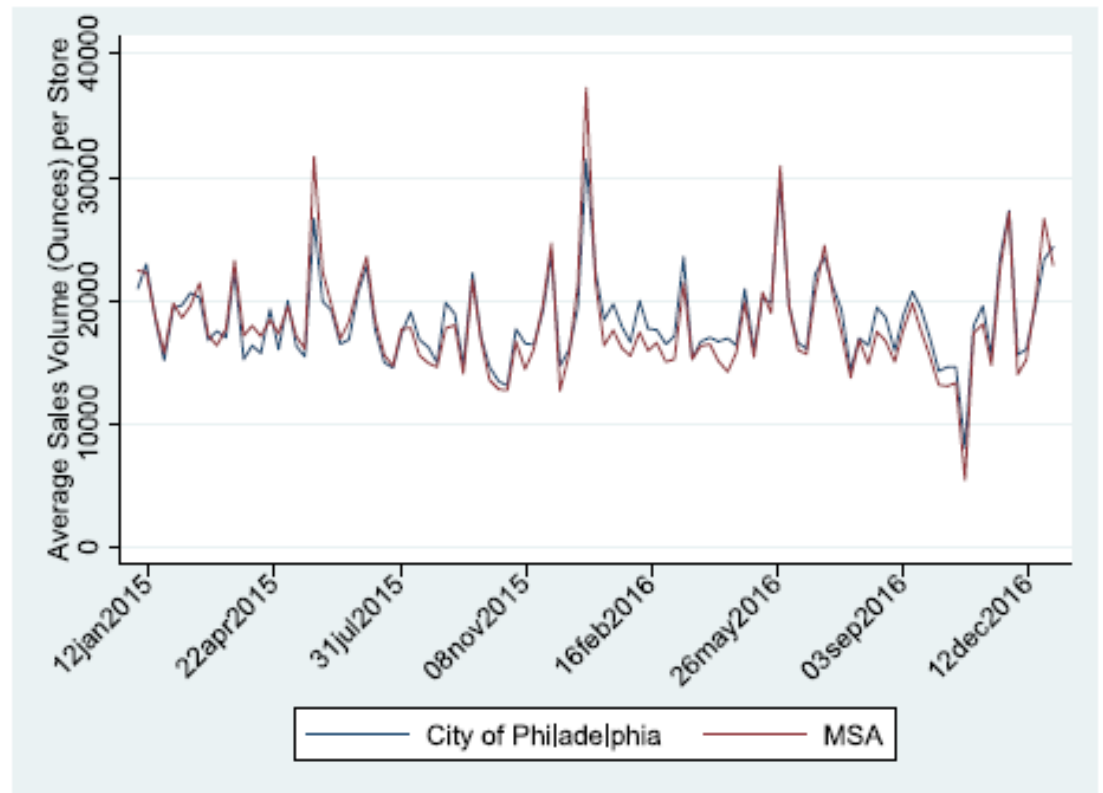
Cawley, Frisvold, Hill, and Jones *JHE* (2019)

Fig. 1. Average Weekly Sales Volume (Ounces) per Store of Regular Soda and Diet Soda in 2015 and 2016 Prior to the Philadelphia Beverage Tax.

Notes: The figure shows the average weekly sales volume of regular soda and diet soda per retail store in Philadelphia and in the Philadelphia MSA (outside of the city) within Pennsylvania throughout 2015 and 2016, prior to the implementation of the Philadelphia Beverage Tax on January 1, 2017. The sample includes stores in the Nielsen data in both 2015 and 2016. The conclusions drawn from the Nielsen data are those of the researchers and do not reflect the views of Nielsen. Nielsen is not responsible for, had no role in, and was not involved in analyzing and preparing the results reported herein.

Source: Researcher(s) own analyses calculated (or derived) based in part on data from The Nielsen Company (US), LLC and marketing databases provided through the Nielsen Datasets at the Kilts Center for Marketing Data Center at The University of Chicago Booth School of Business.

Parallel Trends in Sales of Regular Soda: Oakland vs Comparison Areas
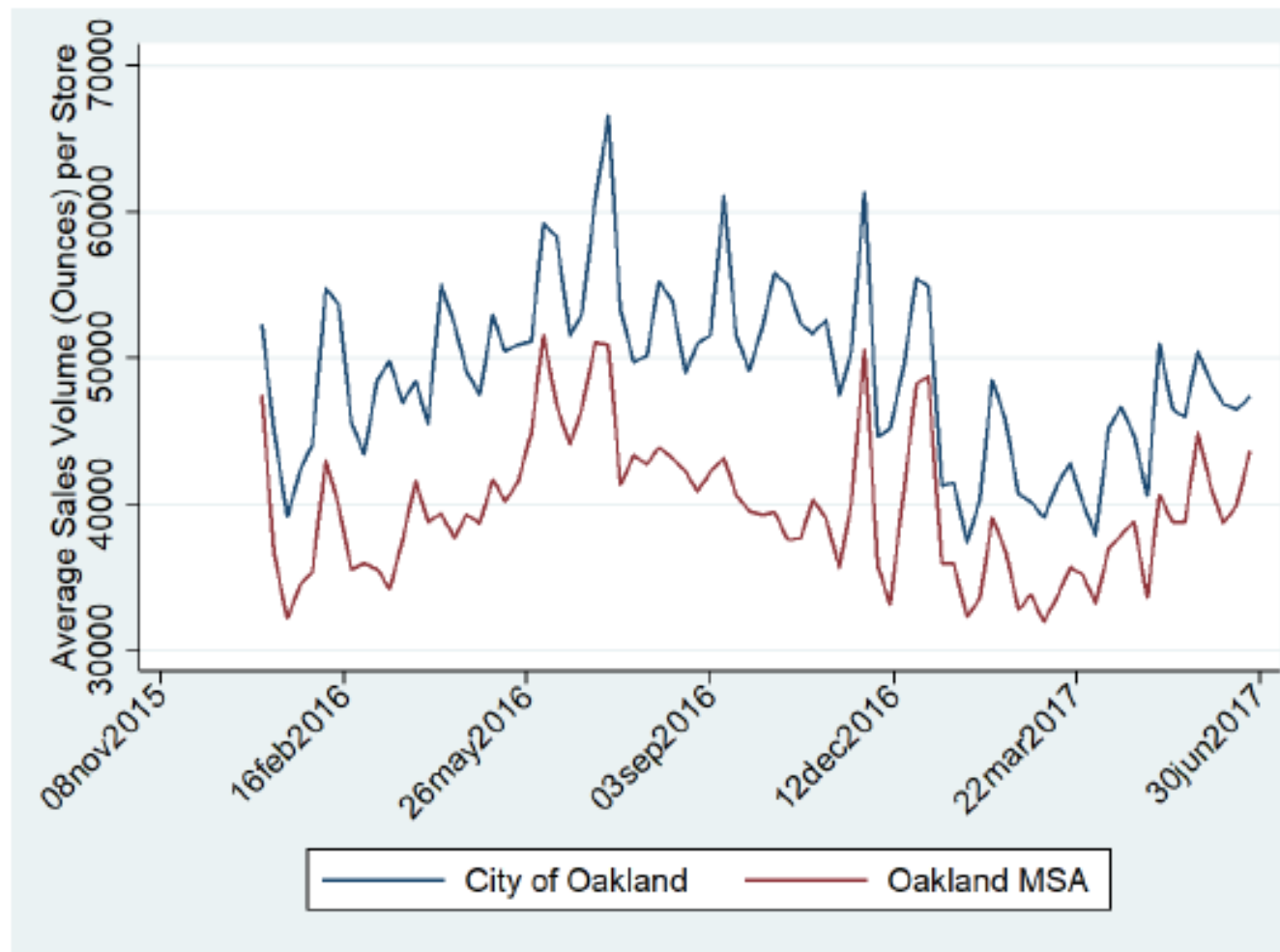
Notes: This figure shows the average weekly sales volume of regular soda per retail stores in Oakland and in the Oakland MSA in the 18 months leading up to the tax (January 2016 to June 2017). The conclusions drawn from the Nielsen data are those of the researchers and do not reflect the views of Nielsen. Nielsen is not responsible for, had no role in, and was not involved in analyzing and preparing the results reported herein.

Source: Researcher(s) own analyses calculated (or derived) based in part on data from The Nielsen Company (US), LLC and marketing databases provided through the Nielsen Datasets at the Kilts Center for Marketing Data Center at The University of Chicago Booth School of Business.

Cawley, Frisvold, Hill, and Jones *EHB* (2020)

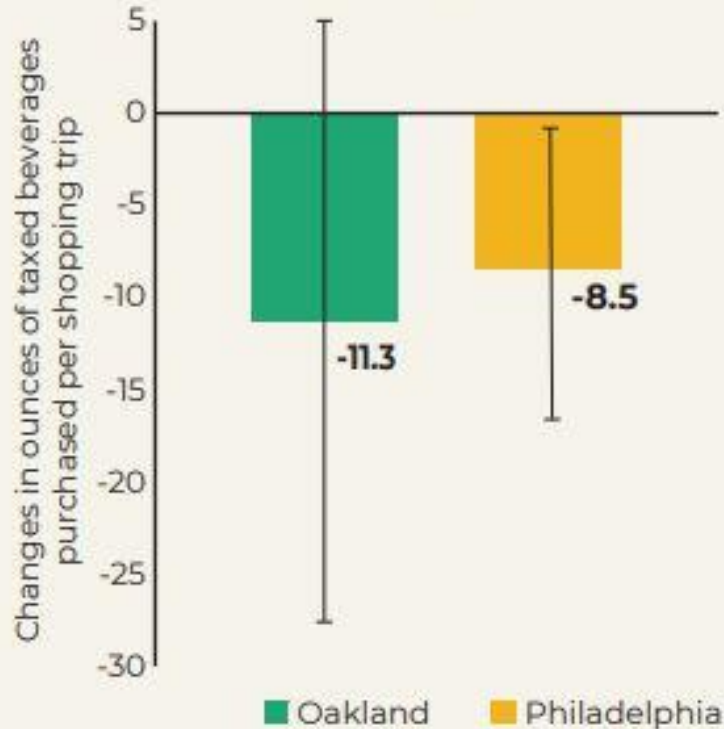# Results: Relative Purchases at Stores in Taxing Cities

Figure 2. Impact of SSB Taxes on Purchases of Taxed Beverages

Notes: The SSB tax in Oakland (1 cent per ounce) did not have a statistically significant impact on the volume of SSBs purchased. The beverage tax on SSBs and diet soft drinks in Philadelphia (1.5 cents per ounce) decreased the purchases of taxed beverages by 8.5 ounces per shopping trip. The height of the bars represent the estimate of the tax's impact on purchases, with the 95% confidence interval shown by the black vertical bracket.

Percent changes:
Philadelphia: -61.6%
Oakland: -58.5%

Baseline Means
Philadelphia = 13.8 oz/shopping trip
Oakland = 19.3 oz/shopping trip

Average of 16 shopping trips/HH/month (Ver Ploeg et al. 2017)

For Philly, decrease equivalent to roughly two 2-liter bottles per month

Cawley, Frisvold, Hill, and Jones (*JHE* 2019, *EHB* 2020)

Second Source of Data on Purchases

2. <u>Household receipt data from InfoScout</u>
   – Participants upload photos of grocery receipts, from which InfoScout creates records for each individual purchase
   – Longitudinal HH data from 6 months before to 6 months after tax
   – Purchases from all retail locations
   – Two control groups:
     • HH in same MSA but outside taxing city
     • Matched HH nationally with similar X, not subject to such a tax
   – Advantages: longitudinal data, see purchases from all stores, many time periods, all beverages, get data from 4 taxing cities (PHL, OAK, SEA, SF), two control groups for each treated city; more obs than Nielsen consumer panel
   – Disadvantages: select sample of shoppers, may not submit all receipts

Data on Purchases

2. Household receipt data from InfoScout

  • Total households: 1,447

Locations	Cities with a tax	MSA comparison group	Matched national comparison group
All locations	483	480	484
Philadelphia	277	274	278
Oakland	34	34	34
San Francisco	123	123	123
Seattle	49	49	49

Methods: Difference-in-Differences

$$Y_{hct} = \alpha_0 + \alpha_1 Tax_{ct} + \delta_h + \gamma_t + \varepsilon_{hct}$$

Y_{hct} = monthly purchases (ounces) of taxed beverages by HH h, in city c, and month t

Tax_{ct} = city-specific, month-specific *tax rate* (=1 after tax, =0 prior to tax, and always =0 in control areas)

δ_h = household fixed effects

γ_t = month fixed effects

Cluster standard errors (alternately) by:
- Household
- The 12 T/C groups (never before possible – past studies only had 1T & 1C group)

TABLE 3 Impact of SSB taxes on beverage purchases (ounces/month)

	All observations	Comparison group: Treatment city MSAs	Comparison group: National matched households
Taxed beverages			
Tax rate			
Point estimate	−53.00	−48.74	−61.71
95% confidence interval			
Clustered at household level	[−86.04, −19.97]	[−84.57, −12.92]	[−96.98, −26.44]
Wild-cluster bootstrap, area clusters	[−93.35, 41.74]	[−109.20, 97.77]	[−114.00, 77.27]
Wild-cluster bootstrap, city clusters	[−84.76, 17.67]	[−79.68, 34.19]	[−91.50, 14.05]
Pretax mean	432.92	429.64	436.18
Observations	17,364	11,556	11,604
Households	1,447	963	967

Estimated effect of 1 cent/oz beverage tax on oz purchased/month.

Source: Cawley, Frisvold, Hill, and Jones, *Health Economics* (2020)

Testing for Parallel Trends: Event Study

Figure 2: Impact of SSB Taxes on Purchases of Taxed Beverages (Ounces/Month)
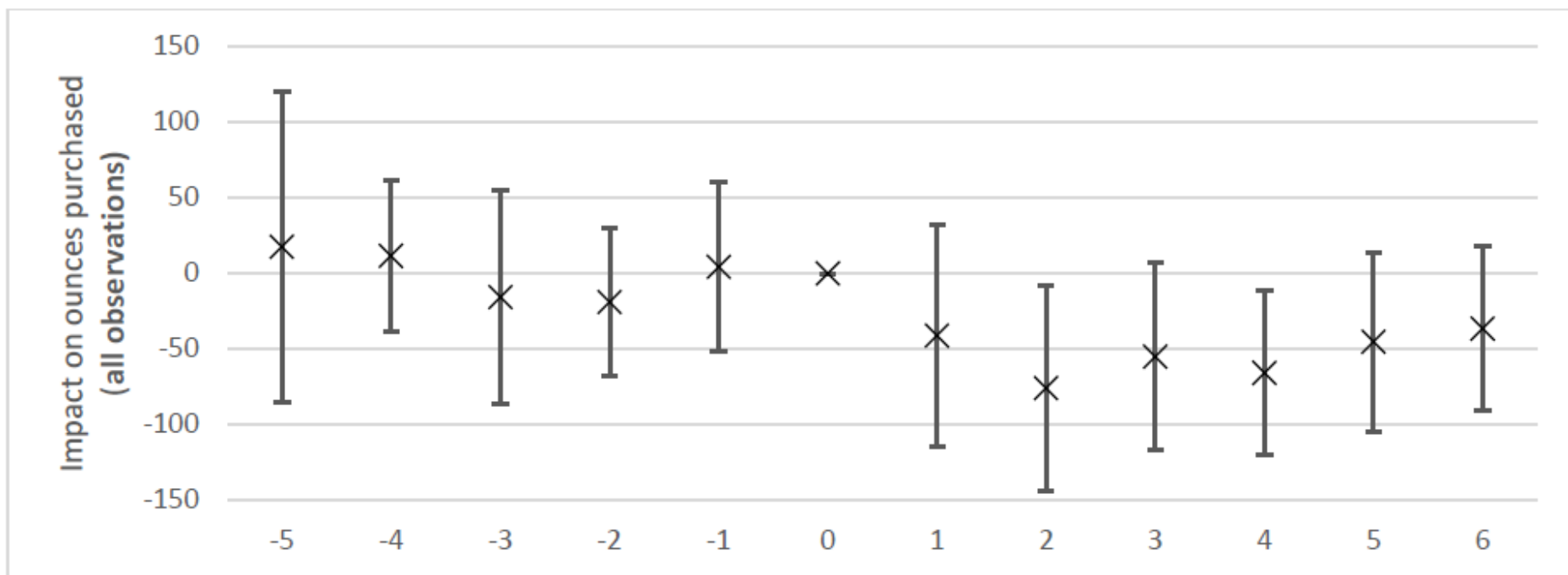
InfoScout data on 4 treated cities and 8 comparison cities pooled. Clustering at HH level. Cawley, Frisvold, Hill, and Jones, *Health Economics* (2020)

Interpretation of InfoScout Results

- Additional tax of 1 cent / oz. lowers HH purchases of taxed beverages by 53 oz. / month
  - Equivalent to roughly one fewer 12-oz can per week per HH
  - 12% decrease
  - 21 calories per day per household
    - Assuming all purchases are soda
  - 5 calories per day per household member
  - Implies reduction of 0.5 pound per household member after 3 years (Hall et al., 2011)

- Effect concentrated within Philadelphia
- No detectable impact on sales of untaxed beverages

Data on Consumption

- Longitudinal household surveys of consumers
  - Start with people intercepted outside stores at baseline
  - Web/phone survey regarding consumption
  - Ask about adults' own consumption, and about consumption of randomly-selected child in the HH (1st such data)
    - Measure beverage consumption using NHANES Dietary Screener Questionnaire – frequency of beverage consumption over past 30 days
    - Calculate added sugar consumed from beverages using National Cancer Institute algorithm for the DSQ
  - Longitudinal: same people surveyed both before the tax and 1 year later; 1st longitudinal data on this question
    - Philadelphia: Nov-Dec of 2016 and 2017
    - Oakland: Apr-June of 2017 and 2018
  - Sample sizes:
    - Philadelphia: N=1,126
    - Oakland: N=1,101

Data on Consumption

Table 2. Number of exit interviews and households surveys completed pre- and post- tax

	Respondents in cities		Respondents in comparison areas	
	Pre-tax	Post-tax	Pre-tax	Post-tax
Exit interviews				
Oakland	785	786	741	766
Philadelphia	600	763	705	738
Household surveys				
Oakland	329	193	361	218
Philadelphia	365	241	321	199

Methods: Change in Consumption

$$Y_{1i} - Y_{0i} = \beta_0 + \beta_1 Phil + \beta_2 Y_{0i} + \beta_3 X_i + \varepsilon_i,$$

- Pool longitudinal data from before and after tax, from both taxing (treated) city and control areas
- Y_{1i} - Y_{0i}: change in consumption for person i
- Treatment indicator *(Phil* or *OAK)* defined based on residence of person i
- Y_{0i}: baseline consumption of person i
- X includes: age, gender, race/ethnicity, education, household income.
- β_1 is the estimated effect of the tax on consumption
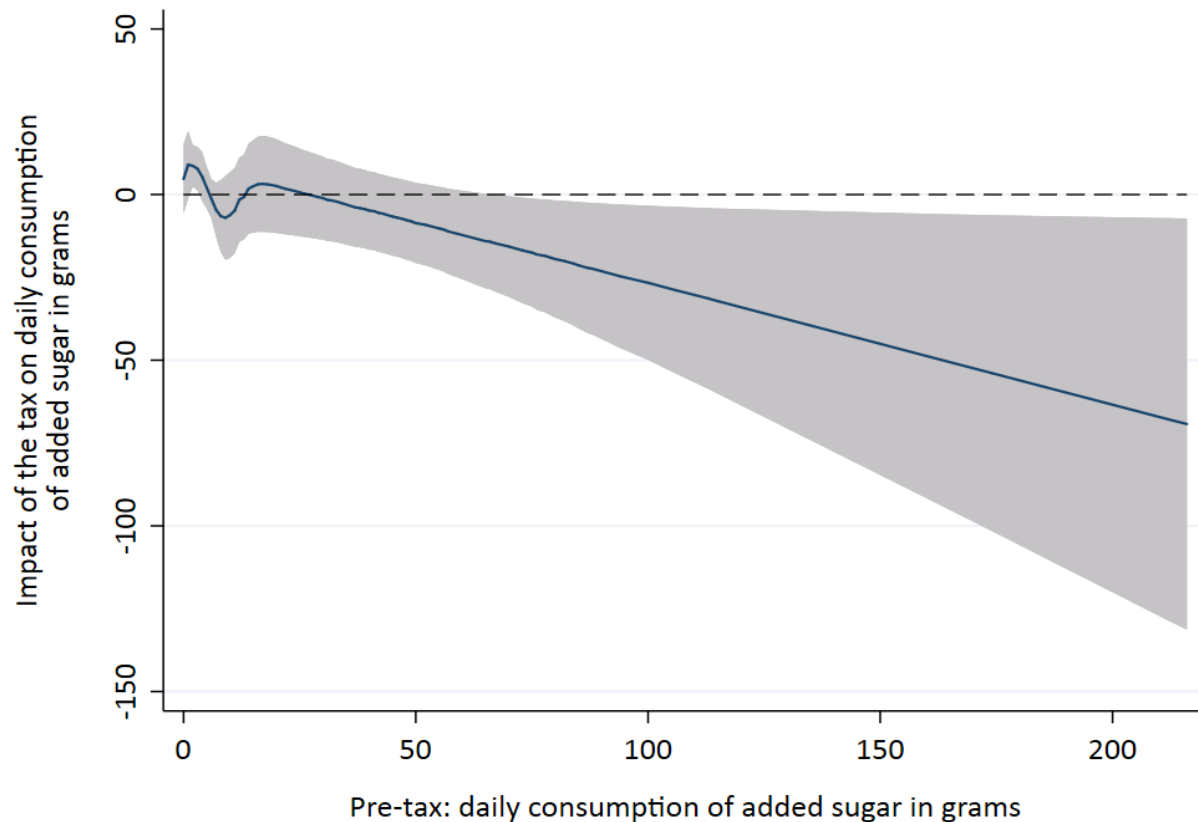
Methods: Change in Consumption (cont.)

$$Y_{1i} - Y_{0i} = \beta_0 + \beta_1 Phil + \beta_2 Y_{0i} + \beta_3 X_i + \varepsilon_i,$$

- General framework analogous to diff-in-diff model
- Given:
  - We observe pre-treatment outcome for both groups (longitudinal data)
  - We observe differences in mean consumption levels between T and C prior to tax
  - We cannot test parallel trends assumption (only 1 pre-tax obs)
  - This approach preferable to diff-in-diff (Imbens and Wooldridge, 2009)
- Identifying assumption: unconfoundedness conditional on the lagged outcome (no unobs variable correlated with both treatment and change in consumption, conditional on X and lagged consumption); Imbens and Wooldridge (2009)
- Cluster standard errors by store (how respondents originally selected)
- Regressions weighted using survey weights at consumer level, which account for sample design, oversampling, and non-response

Impacts on Consumption

- No detectable impact on consumption of added sugars by SSBs in either city

- No detectable impact on frequency of consuming all taxed beverages in either city

- Impacts of Philly tax on adults:
  - Reduced consumption of regular soda by 10.4 times/month (30%)
    - Implied price elasticity of demand for regular soda: -1.02
  - Whether adults consume regular soda *daily*: decrease of 11.1 ppts (31.2%)
  - Whether adults consume *any* taxed beverages: decrease of 5.4 ppts (5.7%)
  - Whether adults consume *any* diet soda: decrease of 16.7 ppts (61.9%)

- No statistically significant changes for children in either city

Impacts for Children, by Baseline Consumption (Philadelphia)

Cawley, Frisvold, Hill, and Jones *JHE* (2019)

Mathematica

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Cross-Border Shopping

- How to reconcile big drop in purchases with limited change in consumption?
- One answer: increased cross-border shopping for taxed beverages
  - Philadelphia:
    - No change in % shoppers intercepted outside Philly who are residents of Philly
    - 35 ppt (208%) increase in percent of Philly residents seen shopping outside of Philly *who buy an SSB*
    - 30.6 oz (184%) increase in SSB purchases by Philly residents seen shopping outside Philly
  - Oakland:
    - No change in % of Oakland residents who report shopping outside Oakland for beverages at least once per week
    - 10.33 ppt (42.0%) increase in shoppers reporting that their usual source of beverage purchases is outside of Oakland

Attempts at Evasion
of WW1 Soda Tax Too

YUM YUM, TASTES BETTER WHEN YOU ESCAPE TAX

NEWSBOYS AVOID SODA TAX BY USING D. C. SIDEWALKS

Fountain Owners Cannot Collect Imposts Unless Refreshments Are Consumed in Building—Law May Be Revised.

COLLECTOR WARNS SODA TAX EVADERS AND ALSO GOUGERS

Can't Escape by Stepping Outside Door to Drink, Says Lederer, in Explaining Prison Feature of New Law

Overall Summary

- SSB taxes largely, but not fully, passed on to consumers
  - Varies by city: 43.1% in Berkeley to complete (~100%) in Philadelphia
  - Estimated pass-through generally higher in store audit data (broader set of stores) than in scanner data (mainly chains)

- SSB taxes reduce *purchases* by consumers in the taxing jurisdiction, especially in Philadelphia
  - Street intercept surveys: tax reduces purchases of taxed beverages <u>from Philly stores</u> of 136 oz/month (61.6%), with no detectable impact in Oakland
  - InfoScout: tax reduces purchases <u>by residents in taxing cities</u> by 53 oz/month (12%) across 4 cities combined; effect concentrated in Philly.

Overall Summary

- Based on longitudinal survey data in Philly and Oakland, the estimated impact on *consumption* is mixed, noisy:
  - No detectable impact on consumption of added sugars (adults or kids)
  - No detectable impact on frequency of consuming all taxed beverages (adults or kids)
  - Some detectable reductions in consumption among Philly adults:
    - 30% reduction (10.4 fewer times/month) in regular soda consumption
    - Price elasticity of demand for regular soda in Philly: -1.02
    - 31% reduction (11.1 ppts) in probability adult consumed regular soda daily
- Cross-border shopping may explain why purchases in treated city fall, but limited change in consumption
  - Aren't necessarily more people doing it
  - But those who do cross-border shop are more likely to buy taxed beverages and to buy more of them
- Difference in results across cities should be expected, and depends on local demand, market factors, and firm responses

Editorial: Thoughts on Tax Design

- If goal is to address externalities and internalities…
- Set amount of tax = MEC (+ what needed to address internalities)
    - Currently, tax rate same for high and low (but non-zero) calorie drinks
- Broaden scope: tax <u>all</u> energy-dense, nutrient-free foods that contribute to obesity and diabetes
    - More fully internalizes externalities
    - Minimizes problem of substitution to similar foods that are untaxed
- Broaden geographic reach:
    - City-level taxes are easily evaded through cross-border shopping
    - Harder to do so with national tax
        - But not impossible: Danish saturated fat tax (2011-12), Norwegian sugar tax

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Thank you!

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