# How Well Are California's Sugar-Sweetened Beverage Taxes Working?

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**California is home to four of eight active local sugar-sweetened beverage (soda) taxes in the United States. The ability of additional California localities to impose soda taxes has been foreclosed by the California Legislature through 2030. We analyze the price and volume impacts of soda taxes in Berkeley, Oakland, and San Francisco and find little pass through of the taxes to final consumers, in most cases, and little impact on retail sales of sugary beverages. The California soda taxes appear to be regressive, hitting low-income consumers hardest.**

The obesity epidemic is estimated to impose $2 trillion in health care costs on the world economy annually and generate economic losses of about 3% of the global gross domestic product. The World Health Organization recommends taxation of sugar-sweetened beverages (SSB) to incentivize healthier diets.

Among eight local SSB taxes or "soda taxes" in operation in the United States, four are in the Bay Area cities of Albany, Berkeley, Oakland, and San Francisco. The rest are implemented in Boulder, Philadelphia, and Seattle and by the Navajo Nation. Taxed products generally include carbonated beverages (i.e., sodas), sports/energy drinks, non-100% juices, and sweetened waters, teas, and coffees. The goals of local SSB taxes are both to raise revenues and to reduce the consumption of sugary beverages that promote obesity, and the health problems associated with it, including type 2 diabetes, cardiovascular diseases, asthma, and several types of cancer.

California communities' ability to implement SSB taxes was halted in 2018 when the California Legislature passed a bill prohibiting new local food or beverage taxes until 2031. The legislation caused the beverage industry to pull back a proposed statewide ballot referendum that would have required all local taxes to pass with at least a two-thirds supermajority. California legislators have subsequently attempted to rescind this law, but, to date, such efforts have failed.

Given the ongoing controversy regarding SSB taxes in California, we studied the impacts on retail prices and sales of SSBs from the taxes that were implemented and are ongoing in Berkeley, Oakland, and San Francisco to gauge their effectiveness in curbing SSB consumption.

## California's SSB Taxes

In November 2014, Berkeley voters passed the first U.S. soda tax of one cent ($0.01) per fluid ounce on SSBs. Although revenues generated by the tax enter the city's general fund, the measure established a panel of experts to make recommendations on the creation and funding of programs to reduce the consumption of SSBs in Berkeley.

Voters in Albany, Oakland, and San Francisco soon followed suit, passing their own one-cent-per-fluid-ounce SSB taxes via referendums in November 2016. These ballot measures sparked vigorous campaigns, with the beverage industry spending nearly $30 million in an unsuccessful effort to defeat the referendums. Tax revenues went to the respective cities' general fund with the expressed goal in the ballot measures that the funds be used to support programs that prevent or reduce the health consequences of consuming SSBs. This "soft earmark"

| Table 1. Characteristics of Stores Within Each Taxed Jurisdiction | | |
|---|---|---|
| **Jurisdiction** | **Store Types** | **Number of Stores** |
| Berkeley | Drug Stores | 6 |
| San Francisco | Grocery Stores | 2 |
| | Drug Stores | 56 |
| | Convenience Stores | 1 |
| | Mass Merchandisers | 5 |
| Oakland | Grocery Stores | 10 |
| | Drug Stores | 10 |
| | Convenience Stores | 6 |
| Source: Information Resources, Inc. | | |

approach enabled the referendums to pass with a simple majority instead of the two-thirds supermajority that is required for implementing taxes to fund a specific purpose.

## SSB Taxes and Modern Food and Beverage Supply Chains

The California SSB taxes are imposed on beverage distributors. Taxes, however, get shifted as products move through the supply chain. The final burden or "incidence" of a tax depends on the extent to which the party bearing the actual impact of the tax is able to shift it forward or backward in the supply chain.

The expectation of supporters of local SSB taxes is that the tax will be shifted forward to retailers or food-service operators and then to consumers in the form of higher prices that then will be a deterrent to the consumption of sugary beverages. The reality of modern food markets, however, is much more complicated than this simple scenario envisions and involves contractual relationships and possible strategic behaviors of distributors, beverage manufacturers, and retailers.

Understanding the portion of tax that is passed through to the end consumer requires knowing first the pass through from distributor to retailer and then from retailer to consumer, and also knowing whether beverage manufacturers adjust prices charged

to distributors operating in jurisdictions subject to an SSB tax. Transactions between food retailers and distributors or manufacturers most often involve negotiated contracts of one or two years with prices that are fixed for the duration. A fixed-price contract could mean that a distributor could not pass forward a tax for up to a year or more. Large chain retailers have considerable bargaining power, making it questionable whether distributors would be able to fully pass forward a beverage tax upon contract renewal, even if they found it optimal to do so.

Depending on the retailer type, SSBs are among dozens to tens of thousands of distinct products sold across different product categories. Higher prices in one category, such as beverages, may cause some consumers to shop elsewhere (e.g., beyond the border of a taxed jurisdiction) for all categories. Thus, a seller that raises prices on taxed beverages may lose not just beverage sales, but also the entire market basket of purchases for some consumers. The more important these cross-category complementarities are, the lower is a seller's optimal pass through of SSB taxes to consumers, especially when the seller is located near the border of a taxing jurisdiction.

Most retail sellers are also chain operators that are present not only in the taxing jurisdiction but many addi-

tional jurisdictions. U.S. chain supermarkets exhibit very little variation in prices across stores, suggesting that prices are established across broad geographical zones and are uniform within those zones. Zone pricing implies that pass through of an SSB tax is not based simply on a local optimizing decision.

These factors suggest that SSB excise taxes are unlikely to be passed forward fully, or perhaps at all, to consumers. Multiple factors also suggest that the pass-through rate may increase overtime and that empirical studies conducted in the immediate aftermath of a tax's imposition may miss much of the impact.

## Data and Empirical Methods

We obtained store-level retail scanner data collected by Information Resources, Inc. (IRI) and provided through a cooperative arrangement with the U.S. Department of Agriculture, Economic Research Service. The dataset includes a large share of food and beverage retailers across the nation. The specific store types included for each jurisdiction are provided in Table 1. Notably, not all store types are represented in all cases, e.g., only drugstore data were available for Berkeley.

From these data, we extracted information on the weekly revenue and the number of units sold for all beverage categories. Each observation contains the sales information at the UPC level for a given store and week. The unit price is calculated as the ratio of weekly sales in cents to weekly units sold.

We used a difference-in-differences (DiD) methodology to estimate the impacts of the SSB taxes on the prices of taxed beverages and their sales volume. This method compares the changes in the outcome measures (i.e., price and quantity sold) at treated stores to those at stores in a control group.

We used a cluster analysis approach to identify a control city for each Bay Area city. For the control cities we chose Minneapolis for Berkeley, Long Beach for Oakland, and New York for San Francisco. The DiD approach we used seeks to find the difference in the treatment variable (SSB price and quantity sold) pre- vs. post-tax and compare these outcomes to the same difference computed in the control city. It is important that the treatment and control city exhibit similar patterns for price and volume in the pre-tax period (known as the parallel trends condition), which we found to be satisfied for each of our treatment- and control-city pairs.

## Results

We studied the Berkeley tax for its first five years, Oakland for its first three years, and San Francisco for its first two, with the shorter time horizons due to the later implementation dates of the taxes in Oakland and San Francisco. Estimation results are reported in Table 2.

Because the treatment variables (price per 12 ounces and volume in 12-ounce units) were measured in their natural logs, impacts of the tax can, with adjustment, be interpreted as percentage changes. For each year and each city, the top number in each row of Table 2 is the estimated percentage change in the treatment variable due to the tax. The statistical significance of the estimated impact is indicated by asterisks, with more asterisks indicating a greater significance level. Absence of an asterisk means the estimated effect is not statistically different from zero at a 90% confidence level or higher. For statistically significant price effects, we report the implied percent pass-through rate in square brackets in the price column. We report the implied price elasticity of demand in square brackets in the sales column. This statistic measures how responsive sales were to the implied price change, with larger absolute

**Table 2**. Average Percent Price and Volume Impact of the SSB Tax on the Taxed Beverages by Jurisdiction and Year After Implementation

| Jurisdiction | Year | Percent Change in Price [Percent Pass Through] | Percent Change in Sales [Implied Price Elasticity of Demand] |
|---|---|---|---|
| Berkeley | Year 1 | 1.53 | -2.12 |
| | | — | [-1.39] |
| | Year 2 | 3.64 | -5.33 |
| | | — | [-1.46] |
| | Year 3 | 1.02 | -10.34 |
| | | — | [-10.14] |
| | Year 4 | 8.65*** | -19.56*** |
| | | [45.10] | [-2.26] |
| | Year 5 | 14.74*** | -20.22** |
| | | [76.86] | [-1.37] |
| Oakland | Year 1 | 6.34** | -0.62 |
| | | [25.21] | [-0.09] |
| | Year 2 | 7.54** | -2.24 |
| | | [29.82] | [-0.29] |
| | Year 3 | 7.94* | 1.67 |
| | | [31.73] | — |
| San Francisco | Year 1 | 3.84** | -0.45 |
| | | [26.51] | [-0.11] |
| | Year 2 | 8.33*** | -0.41* |
| | | [57.58] | [-0.05] |

Notes: Columns contain results for the percentage change in the price and the volume of sales. Year 1 through year 5 refer to the year post implementation. The calculated pass-through rates and implied price elasticities are in square brackets. ***, **, and * denote 99%, 95%, and 90% significance levels, respectively. Percent pass through is computed only for significant price effects.

values implying a greater percent sales response to the estimated percent price change.

Berkeley's tax had no discernible impact on either price or sales for the drug stores in the dataset for the first three years of the tax. However, 45% of the tax was passed through in year 4 and 77% in year 5, which led to significant sales reductions of about 20%—an elastic sales response to the price change. The higher pass-through rate for Berkeley in years 4 and 5 may be due to the implementation of SSB taxes during this time in neighboring Albany, Oakland, and San Francisco, which reduced consumers' incentives for cross-border shopping.

Oakland's tax raised the average price of sugar-sweetened beverages by 6–8% in years 1 through 3, with

a pass-through rate of only 25–30%. No significant change in sales was detected in response to these small price increases. San Francisco also saw modest price increases of about 4% in year 1 and 8% in year 2, but, again, these price changes produced almost no effect on the sales of SSBs.

These results are not encouraging for proponents of SSB taxes because they indicate, first, that only a small portion of the tax passed through to consumers, an unsurprising result for the reasons we noted and, second, that the small changes in SSB prices didn't produce much impact on sales. The larger impact for Berkeley in years 4 and 5 does suggest, however, that the pass-through rate may increase over time and, in turn, generate a greater impact on sales.

**Table 3**. Price and Volume Impacts of SSB Taxes by the Median Household Income Level

| Jurisdiction | Income Levels | Percentage Change in Price [Percent Pass Through] | Percentage Change in Sales [Implied Price Elasticity of Demand] |
|---|---|---|---|
| San Francisco | Low-Income | 8.3*** | -1.9 |
| | | [64.0] | [-0.23] |
| | Middle-Income | 14.7*** | -2.1 |
| | | [100.0] | [-0.14] |
| | High-Income | 2.9 | 5.1* |
| | | [27.5] | — |
| Oakland | Low-Income | 7.5* | 22.7 |
| | | [41.7] | — |
| | Middle-Income | 12.4*** | 6.1 |
| | | [75.2] | — |
| | High-Income | 3.2 | -2.0 |
| | | [17.5] | [-0.64] |

Note: The calculated pass-through rates and implied price elasticities are in square brackets. ***, **, and * denote 99%, 95%, and 90% significance levels, respectively.

## Distributional Impacts

A key goal of SSB tax policies is to reduce soda consumption among the most at-risk populations, which have been found to include low-income households that, on average, spend substantially more on carbonated beverages (sodas) than households in the higher-income categories. Low-income households are, thus, likely to bear a disproportionate share of the tax burden, meaning SSB taxes are likely to be regressive. This regressivity can be minimized if 1) low-income consumers have a very elastic volume response to an SSB tax, and/or 2) low-income neighborhoods see a lower pass through of the tax relative to middle- and upper-income neighborhoods.

To investigate distributional issues, we identified each store's zip code location and ordered zip codes in each taxing jurisdiction according to median household income levels, treating the lowest third as "low income," the middle third as "middle income," and the top third as "high income" locations. Given that Berkeley is home primarily to high-income residents, we restricted this analysis to Oakland and San Francisco. Because most grocery and mass merchandiser chains set prices uniformly across locations, we restricted this analysis to convenience stores and drug stores.

We then asked if price effects (pass through) and sales outcomes due to the tax differed based on the income demographic. Results are contained in Table 3 and show some weak evidence that prices increased more in low- and middle-income neighborhoods than in high-income neighborhoods. There is no evidence, however, of statistically significant decreases in SSB sales for any of the income categories. This finding supports a conclusion that the SSB taxes in Oakland and San Francisco were both largely ineffective in reducing SSB purchases and regressive in their incidence. We find no evidence that low-income households significantly reduced purchases of SSBs in response to the tax. They, therefore, bore the burden of the tax that was passed forward without improving their health outcomes.

## Discussion

Our analysis is limited to those retailers that participated in IRI's data-collection process and also excludes food-service operations. Among stores analyzed, we find evidence that the SSB taxes implemented in Berkeley, Oakland, and San Francisco were passed through to consumers to only a limited degree, with years 4 and 5 of the Berkeley tax providing somewhat higher pass-through rates. Impacts on SSB sales were minor and statistically insignificant in all instances except years 4 and 5 in Berkeley. Given that purchases were little impacted by the taxes, they were quite effective in raising revenues. However, the downside is that this revenue is disproportionately paid by lower-income households.

## Authors' Bios

Hairu Lang received her Ph.D. from the ARE department at UC Davis and currently works for LinkedIn Corp. Kristin Kiesel is an associate teaching professor and Richard J. Sexton is a Distinguished Professor, both in the ARE department at UC Davis. They can be reached at hlang@ucdavis.edu, kiesel@ucdavis.edu, and rjsexton@ucdavis.edu respectively.

**For additional information, the authors recommend:**

Lang, Hairu. 2022. "The Impact of Soda Taxes in the U.S.: Empirical Evidence and Comparison Across Jurisdictions." Ph.D. Dissertation, University of California, Davis. Available at: http://bit.ly/3RP3Zig.

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