An Analysis of the Impact of California's 2020 State-wide Sugar-Sweetened Beverage Tax on Quantity Demanded

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On June 28, 2018 Assembly Bill 1838 was passed in the state of California which approved a statewide local soda tax ban. Assembly Bill 1838 was passed after Gov. Jerry Brown compromised with the beverage industry, which had funded a ballot measure earlier in the year that would have made it tougher for local governments across the state to raise new revenues (Becerra, 2017). Assembly Bill 1838 bans all new local soda taxes until 2031 and attempted to halt an ongoing wave of local taxes on sugary drinks (Becerra, 2017). In a direct response, in July of 2018 the California Medical Association and California Dental Association proposed the California Sugar-Sweetened Beverages Tax act of 2020, a statewide tax on sugary beverages that would override Assembly Bill 1838. If passed, the proposed initiative would create a new two cents per ounce excise tax on sugary drinks starting July 1, 2021 across the state. While the proposal still requires the signature of 585,407 registered voters to qualify for the 2020 ballot (Jeff, 2018), this memo examines the effect of the proposed excise tax on the demand of regular and diet Coke across California. While the precise effect of the tax cannot be known until implemented and evaluated, based on previous research we expect a state-wide tax to be shared by both consumers and producers, quantity demanded of sugar-sweetened beverages will decline, and the state will generate some revenue to address negative externalities associated with the consumption of sugar-sweetened beverages.

POLICY BACKGROUND

In November 2014, Berkeley, California, became the first U.S city to pass a law (Ordinance 7388-NS) taxing sugary beverages. The ordinance levied an excise tax of one cent ($0.01) per fluid ounce on the distribution of sugar-sweetened beverage products in the city (Ordinance No. 7,388-N.S.,2015). Since the Berkley ordinance, other major cities across the country have followed suit and have implemented similar “soda taxes”, including Seattle Washington, Chicago Illinois, and

Boulder Colorado. This year, California health advocates are advocating for a state wide $0.02 excise tax on sugary drinks. According to the Legislative Analyst Office, California Legislature's Nonpartisan Fiscal and Policy Advisor, it is estimate that the new tax would raise roughly $2 billion to $3 billion in revenue annually, beginning in 2022-23 (Mac, 2018). While dependent on decisions made by the state legislature and by the Governor, revenue from the tax could be spent on state health care programs, diseases prevention and research, and increases access to healthy food (Mack, 2018).

METHODOLOGY

The following calculations estimate the extent to which the proposed state-wide "soda tax" of $0.02 affects total quantity demanded of regular and diet Coke soda. Calculations do *not* include the average price, quantity demanded or elasticity of other sugar-sweetened beverage products such as sports drinks or fruit drinks. There are four key components necessary to estimating the change in demand of soda if the California Sugar-Sweetened Beverages Tax were approved:

a. **Current demand of soda in California ($Q_{D)}$**

According to the most recent data available by the Center for Science in the Public Interest, in 2013 the average American drank 38 gallons of soda a year, or about eight 12-ounce cans a week (CSPI, 2017). According to the Census Bureau, as of July 1, 2017 California has an estimated population of 39.5 million people (Census Bureau, 2017). Utilizing California's most recent population figures, we estimate California consumes approximately 1.5 billion gallons of soda a year, or 2.8 billion 2-liter bottles.

b. Current average price of regular and diet Coke in California (P_O)

The current average price of a 2-liter bottle of Coke in California is $2.15 (Cawley, 2016). This estimate includes the California 7.25 % base sale and use tax but does not include the proposed

excise tax of $0.02 cents. For the purpose of this memo, this price estimate will be used in calculations for both regular Coke and diet Coke.

c. New price of soda after proposed state-wide "soda tax" ($P_{N)}$

Given, there are 67.628 ounces of soda in a 2-liter bottle, in monetary terms, if passed the California state-wide of two cents per ounce excise tax on sugary drinks would result in a $1.35 tax on a 2-liter bottle of soda. According to the California Department of Tax and Fee Administration, California currently has a total statewide base sale and use tax rate of 7.25%, where 6.00% is state sales tax rate and 1.25% is the local sales tax rate. Therefore, assuming the average price of a 2-liter soda is $2.15, after a $0.02 tax per ounce, we estimate that the price of a 2-liter bottle soda will increase to a range between $2.68 and $3.40, depending on the three degrees of pass through. We assume three different passthrough scenarios because principles of microeconomics tells us that while a tax is placed on the producers (i.e. the distributors of sugary drinks) and whole sellers, the tax will be passed along and will be incorporated into the retail price by producers, ultimately resulting in consumers bearing a portion of the tax burden. Therefore, we assume three scenarios, (a) consumers bears 75% of the tax, (b) consumer bears 25% of the tax, and (c) consumer and producers bears 50% of the tax.

d. The price elasticity of demand of Regular Coke soda and Diet Coke

Finally, to capture changes in demand based on price, we must factor in price elasticity of demand of regular and diet Coke. Where the price elasticity of demand rates illustrate the responsiveness of consumer quantity demanded based on price; the percentage change in quantity demanded resulting from a given percentage change in price. According to Emily Yuai Wang in "The Impact of Soda Taxes on Consumer Welfare: Implications of Storability and Taste Heterogeneity" which provides analysis on the effectiveness of soda taxes using a demand model that unlike previous

models addresses potential substitution and stockpiling, suggest long run elasticity demand of regular Coke soda is -1.2016 and -1.0000 (unit-elastic) for diet Coke (Wang, 2015). Meaning if the price of regular Coke soda increases by 1%, its demand will fall by about 1.20%. This indicates that on average consumers are somewhat likely to substitute regular Coke for other sweetened beverages when the price of regular Coke goes up. Meanwhile, in the case of diet Coke, when the price of diet Coke increases by 1%, its demand will fall by 1%. Given these two elasticities we calculate new quantity demanded for the state of California for both regular Coke soda and diet Coke.

RESULTS

Regular Coke Soda : When 75% of the burden is placed on consumers, consumers pay $3.40 for a two-liter of regular soda, quantity demanded decreases from 1.5 billion gallons of soda to 455 million gallons. When 25% of the burden is placed on consumers, consumers pay $2.68 for a two-liter of regular Coke soda, quantity demanded decreases from 1.5 billion gallons of soda to 1.049 billion gallons. Finally, when consumers and producers share equally the tax burden, consumers pay an estimated $3.03 per 2-litter of regular soda, and quantity demanded is expected to drop from 1.5 billion to 761 million gallons of regular soda per year. In all three scenarios there is a decrease in total quantity demanded of regular Coke soda and an increase in price. The highest decrease in quantity demanded in when consumers pay 75% of the tax burden and price increases by $1.25. Detailed calculations are available in the Appendix in Figure. 2

Diet Coke Soda: When 75% of the burden is placed on consumers, consumers pay $3.40 for a two-liter of diet soda, quantity demanded decreases from 1.5 billion gallons of soda to approximately 630 million gallons**.** When 25% of the burden is placed on consumers, consumers pay $2.68 for a two-liter of diet Coke soda, quantity demanded decreases from 1.5 billion gallons

of soda to approximately 1.1 billion gallons. Finally, when consumers and producers share equally the tax burden, consumers pay $3.03 per 2-litter of diet Coke soda the total quantity demanded from 1.5 billion gallons of soda to approximately 885 million gallons. Again, the biggest change is demand is apparent when consumers are asked to pay for 75% of the tax burden and price increase by $1.25 . Detailed calculations are available in the Appendix in Figure. 2

CONCLUSION

While California's proposed $0.02 excise tax on sugary drinks still has a long road ahead before making on to the 2020 ballot, some health experts consider it an important first step that may yield incremental yet important health gains for California residents. While we did not examine *all* sugary drinks on the market in this memo, we expect that if placed on the ballot and approved, a $0.02 per ounce tax on sugary drinks has the potential to dramatically alter supply and demand across the state. For regular and diet Coke in particular, we expect the supply curve to shift inward as price of soda increases and the quantity demanded to decrease regardless of how much consumers endure the burden of the tax. The biggest decrease in demand in Coke is expected when consumers bear the majority of the tax burden (75%) and pay an average of $3.40 per 2-liter of regular and diet Coke, reducing demand by approximately 1 billion gallons across the state. At the same time, we expect the state of California to generate substantial funds to address negative externalities associated with the consumption of sugar-sweetened beverages, given demand for Coke and diet Coke is pretty inelastic. Please see Figure 3 in Appendix. Ultimately, while the fate of the tax still remains uncertain, and we provide broad predictions, this memo begins a larger conversation attempting to assess the impact of popular "soda taxes" across the country and illustrates the potential effect of taxes on the demand and consumption.

Appendix

Figure 1: Consumer Burden

Price Elasticity of Demand Formula	Elasticity $^{D} = \frac{\frac{Q_n - Q_o}{Q_o}}{\frac{P_n - P_o}{P_o}}$
P_{old}	Average Price of 2-liter bottle of soda *prior* to proposed $0.02 state tax.
P_{new}	Average Price of 2-liter bottle of soda *after* proposed $0.02 state tax.
Q_{old}	Estimated number of 2-liter bottles (in gallons) of soda sold in CA *prior* to $0.02 tax.
Q_{new}	Estimated number of 2-liter bottles (in gallons) of soda sold in CA *after* $0.02 tax.

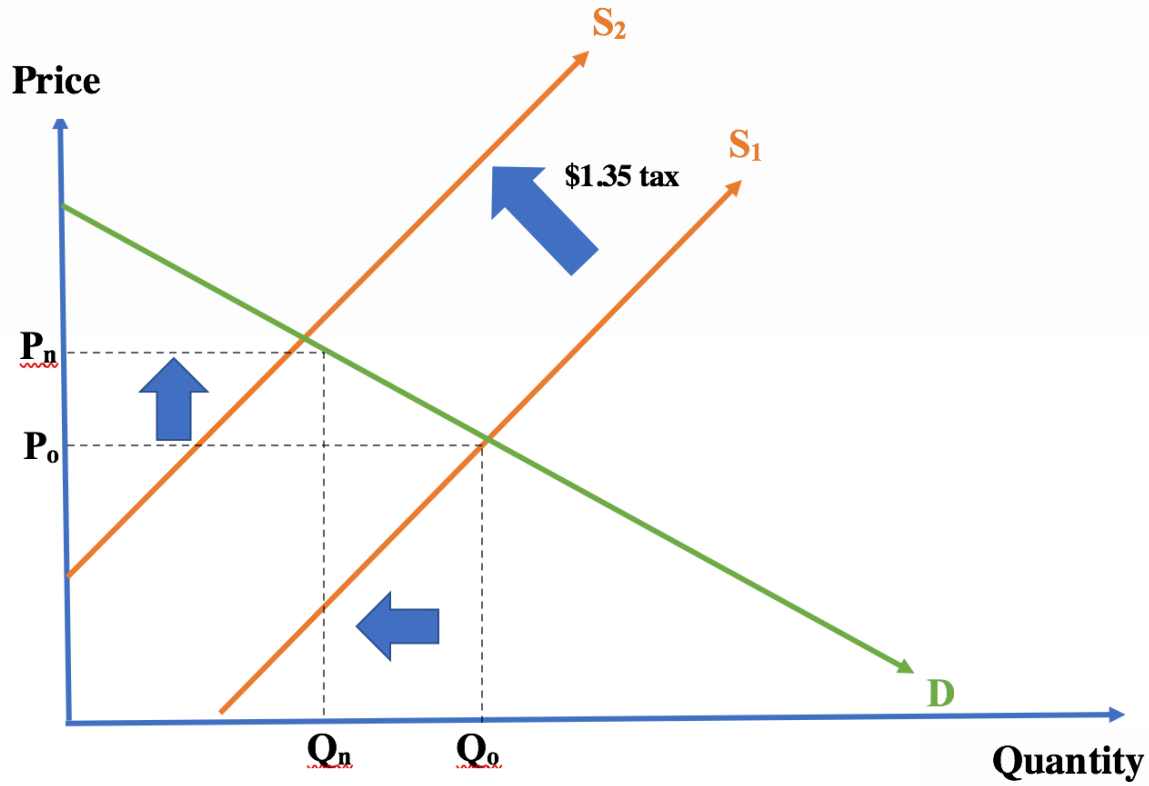
Consumer Burden	**Calculations** [(P_{old} + %tax) * 7.5% CA Sales Tax	**New Price**
P_{new1} Consumer Bears 75% tax	[$2.15 + $1.35(0.75)] * 7.5% [$2.15 + $1.01] * 7.5% $3.16 * 7.5% = 0.237 $3.16 + 0.24 = $3.40	P_{new1} = $3.40
P_{new2} Consumer Bears 25% tax	[$2.15 + $1.35(0.25)] * 7.5% [$2.15 + 0.34] * 7.5% $2.49 * 7.5% = 0.187 $2.49 + 0.19 = $2.68	P_{new2} =$2.68
P_{new3} Consumer Bears 50% tax	[$2.15 + $1.35(0.50)] * 7.5% [$2.15 + 0.67] * 7.5% $2.82 * 7.5% = 0.211 $2.82 + 0.211 = $3.03	P_{new3} =$3.03

Figure 2: Price Elasticity of Regular and Diet Coke Soda

Definitions	
Elasticity, Regular Coke Soda (ED_1)	$ED_1 = -1.2016$
Elasticity, Diet Coke Soda (ED_2)	$ED_2 = -1.0000$
Old Quantity Demanded (O_{old})	$Q_{old} = 1.5$ Billions of Gallons
New Quantity Demanded (Q_1)	$Q_{new1} = 455$ Million Gallons $Q_{new1} = 630$ Million Gallons
New Quantity Demanded (Q_2)	$Q_{New2} = 1.049$ Billion Gallons $Q_{New} = 1.125$ Billion Gallons
New Quantity Demanded (Q_3)	$Q_{New3} = 761$ Million Gallons $Q_{New3} = 885$ Million Gallons
Price Elasticity Formula	$Q_{new1} = (ED_1)\ (Q_{old})(\Delta P) + Q_{old}$ $Q = (ED)\ (Q_{old})\ (P_{new} - P_{old}/P_{old}) + Q_{old}$

	Elasticity #1 **Regular Coke Soda** $ED_1 = -1.2016$	**Elasticity #2** **Diet Coke Soda** $ED_2 = -1.0000$
P_{new1}	**$Q_{new1} = (ED_1)\ (Q_{old})(\Delta P) + Q_{old}$** = (-1.2016) (1.5) ($3.40-$2.15/$2.15) + 1.5 = (-1.2016) (1.5) ($1.25/$2.15) + 1.5 = (-1.2016) (1.5) ($0.58) + 1.5 = 0.455 **≈ 455 Million Gallons**	**$Q_{new1} = (ED_2)\ (Q_{old})(\Delta P) + Q_{old}$** = (-1.00) (1.5) ($3.40-$2.15/$2.15) + 1.5 = (-1.00) (1.5) ($1.25/$2.15) + 1.5 = (-1.00) (1.5) (0.58) + 1.5 = 0.63 **≈ 630 Million Gallons**
P_{new2}	**$Q_{new2} = (ED_1)\ (Q_{old})(\Delta P) + Q_{old}$** = (-1.2016) (1.5) ($2.68-$2.15/$2.15) + 1.5 = (-1.2016) (1.5) ($0.53/$2.15) + 1.5 = (-1.2016) (1.5) ($0.25) + 1.5 = 1.049 **≈ 1.049 Billion Gallons**	**$Q_{new2} = (ED_2)\ (Q_{old})(\Delta P) + Q_{old}$** = (-1.00) (1.5) ($2.68-$2.15/$2.15) + 1.5 = (-1.00) (1.5) ($0.53/$2.15) + 1.5 = (-1.00) (1.5) (0.25) + 1.5 = 1.125 **≈1.125 Billion Gallons**
P_{new3}	$Q_{new3} = (ED_1)\ (Q_{old})(\Delta P) + Q_{old}$ = (-1.2016) (1.5) ($3.03-$2.15/$2.15) + 1.5 = (-1.2016) (1.5) ($0.88/$2.15) +1.5 = (-1.2016) (1.5) (0.41) + 1.5 = 0.761 **≈ 761 Million Gallons**	$Q_{new3} = (ED_2)\ (Q_{old})(\Delta P) + Q_{old}$ = (-1.00) (1.5) ($3.03-$2.15/$2.15) + 1.5 = (-1.00) (1.5) ($0.88/$2.15) +1.5 = (-1.00) (1.5) ($0.41) +1.5 = 0.885 **≈ 885 Million Gallons**

Figure 3: Coke Market under California Sugar-Sweetened Beverages Tax Act of 2020



As a result of a $1.35 tax, supply decreases, soda prices increases, quantity of soda demanded decreases.

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