

Employment Impact of Sugar-Sweetened Beverage Taxes

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Sugar-sweetened beverages (SSBs) are the leading source of added sugar in the American diet and are associated with increased risk of type 2 diabetes, cardiovascular disease, dental caries, osteoporosis, and obesity.^{1–4} From 1988–1994 to 1999–2004, average daily caloric intake of SSBs increased from 157 to 203 kilocalories among adults and from 204 to 224 kilocalories among children aged 2 to 19 years.^{5,6} Recently, SSB consumption prevalence fell across all age groups from 1999–2000 to 2007–2008, although the prevalence of sports and energy drinks increased and heavy SSB consumption (≥ 500 kcal/day) increased among children.^{2,7} In 2009–2010, obesity rates among children and adults were 16.9% and 36.9%, respectively,^{8,9} and the annual health care cost burden of obesity was recently estimated to be \$209.7 billion.¹⁰ Thus, reducing SSB consumption is considered a key public health objective.

SSB taxes have been proposed as a means of changing individuals' behavior to reduce obesity and improve health.^{11,12} From a tax administration vantage, it is less complicated to tax food categories than nutrients, particularly categories with little or no nutritional value such as SSBs. As of January 1, 2012, state-level taxes on soda sold in grocery stores existed in 35 states, with a mean tax rate of 5.17% in taxing states and 3.55% across all states.¹³ Evidence suggests that a SSB-specific tax that increases prices by 20% would reduce consumption by 24%.¹³ However, evidence of relationships between SSB prices and taxes and body weight is mixed, largely because of the very low levels of existing taxes that are applied to both regular and low- or no-calorie beverages,^{13,14} although studies that simulate larger price changes predict lower body weight outcomes.^{15,16}

In the past few years, numerous state and local legislators have proposed significant taxes on SSBs¹⁷—some at 2 cents per ounce, with many at a penny per ounce, equivalent to about 20.0%–35.0% of price, depending on how SSBs are sold. Although such proposed SSB

Objectives. We assessed the impact of sugar-sweetened beverage (SSB) taxes on net employment.

Methods. We used a macroeconomic simulation model to assess the employment impact of a 20% SSB tax accounting for changes in SSB demand, substitution to non-SSBs, income effects, and government expenditures of tax revenues for Illinois and California in 2012.

Results. We found increased employment of 4406 jobs in Illinois and 6654 jobs in California, representing a respective 0.06% and 0.03% change in employment. Declines in employment within the beverage industry occurred but were offset by new employment in nonbeverage industry and government sectors.

Conclusions. SSB taxes do not have a negative impact on state-level employment, and industry claims of regional job losses are overstated and may mislead lawmakers and constituents. (*Am J Public Health.* 2014;104:672–677. doi:10.2105/AJPH.2013.301630)

taxes are substantial, they are below excise taxes on cigarettes, which currently account for about 44.2% of retail cigarette prices in the US.¹⁸ New SSB taxes would raise substantial revenue that could be dedicated to health promotion.¹⁹ However, none of these proposals has succeeded, at least partly because of opposing lobbying efforts by the beverage industry. In 2009, soft drink companies and the American Beverage Association spent \$40.3 million lobbying the federal government, up from \$1.3 million in 2005.²⁰ The American Beverage Association spent substantial additional funds lobbying at the state and local levels, for example, \$16.7 million to repeal the 2010 Washington state tax legislation²⁰ and \$4.0 million aimed at defeating the Richmond and El Monte, California, 2012 ballot measures.²¹

A primary argument industry uses against SSB taxes is that they will cause considerable regional job losses. Indeed, a recent study showed that the most frequent opposing argument in news coverage of public debates over SSB taxes focused on how such taxes would hurt the economy.²² Although industry's job loss argument has resonated with citizens and lawmakers, especially during the recent recession, industry-sponsored research supporting it is subject to several limitations in its methods and assumptions. Job loss arguments by the beverage industry are overstated for 3 reasons. First,

partially offsetting increased consumption of non-SSBs, which are often produced by the same companies, is not fully accounted for. Second, the increases in jobs created elsewhere in the economy as consumers reallocate their spending to nonbeverage goods and services are ignored. Third, the economic activity that tax revenue generates is not accounted for.

For many years, tobacco companies made similarly incomplete arguments in opposition to tobacco taxes and other tobacco control policies, claiming that adoption of such policies would harm the economy by causing numerous job losses.^{23,24} Tobacco industry-sponsored studies were increasingly scrutinized and refuted by more rigorous, independent analyses concluding that industry-sponsored studies significantly overstated the economic impact of tobacco and that there would be net job gains nationally as a result of reductions in tobacco use induced by stronger tobacco control policies.^{25–27}

We provide an independent comprehensive assessment of the employment impact of SSB taxes. We estimated the net employment effect by accounting for the effects of the direct reduction in SSB consumption, the substitution to non-SSB consumption, and the effects from the generated tax revenue. Specifically, we estimated the impact of a 20% state-level SSB tax on employment in Illinois and California.

METHODS

We used a macroeconomic simulation model to assess employment impacts that account for changes in the demand for inputs into SSB production and the effects across state-level economies that result from consumers, firms, and governments reallocating their spending in response to changes in consumption induced by the introduction of a 20% SSB tax in 2012.

Macroeconomic Model

To simulate the net employment impact from the implementation of SSB taxes in Illinois and California, we used the Regional Economic Models, Inc. (REMI) model. The REMI model is a structural economic forecasting and policy analysis model widely used by state and regional governments. Using the REMI model, Warner et al.^{26,27} found that, by contrast to the negative gross employment changes the tobacco industry predicted, the net effects of tobacco control policies were positive once the full range of offsetting economic adjustments were included. The REMI model has been used recently to examine the employment impact of a tax credit program in Michigan,²⁸ the contribution of educational institutions to state economies,²⁹ and the economic impact of the 9/11 disaster in New York.³⁰

The richness of the REMI model structure has a unique capacity to accurately and fully gauge the response of a regional economy to policy-driven changes. The model is dynamic, with economic forecasts and simulations generated annually, and includes behavioral responses to compensation, price, and other economic factors. The overall model structure is described in detail elsewhere^{31,32} but can be summarized in 5 major blocks:

1. output and demand (consisting of output, demand, consumption, investment, government spending, exports, and imports, including feedback from output change owing to the change in the productivity of intermediate inputs);
2. labor and capital demand (including the determination of labor productivity and intensity and the optimal capital stocks);
3. population and labor supply (including detailed demographic information about the region);

4. compensation, prices, and costs (including delivered, production, equipment, housing and consumer prices, and the compensation equation); and
5. market shares (including equations that measure the proportion of local and export markets that are captured by each industry).

We used the model's 169-sector structure to conduct analyses of the soft drink industry. We modeled changes in SSB demand, substitution between beverages, income effects (net change in purchasing power or income for consumers who purchase fewer SSBs but pay higher prices), and government spending of new tax revenues.

Model Inputs and Assumptions

Taxed SSBs included regular carbonated beverages, fruit drinks, isotonic beverages (e.g., sports drinks), energy drinks, ready-to-drink tea and coffee, and flavored or enhanced water. Substitute beverages not subject to taxation included diet carbonated beverages, diet ready-to-drink tea, diet flavored or enhanced water, 100% fruit juice, milk, bottled water, and tap water. We obtained beverage prices from retail prices collected nationally by the Robert Wood Johnson Foundation–funded Bridging the Gap project. We considered tap water free.

We obtained total regional gallons consumed for 2010 for each beverage category from the Beverage Marketing Corporation and generated state-level population-based estimates of consumption.^{33–37} We extrapolated state-level gallons of tap water consumed from dietary recall data from the 2009–2010 National Health and Nutrition Examination Surveys.

We split total beverage sales in each state between retailers and manufacturers using the grocery store gross margin of 27.8% estimated by the Census Bureau's 2009 retail industry study.³⁸ Splitting total revenue between the beverage industry's manufacturing and non-manufacturing sectors was important, as retailing is much more labor intensive than is manufacturing. We assumed most beverages to be manufactured by "soft drink & ice manufacturing" (North American Industry Classification System [NAICS] 31211), which includes purifying and bottling water. Two exceptions were milk—assumed to be

manufactured by fluid milk manufacturing (NAICS 311511)—and juice—assumed to be manufactured by frozen fruit, juice, and vegetable manufacturing (NAICS 311411).

Using estimates from a recent review of SSB demand studies,¹³ we calculated the reduction in taxed beverages on the basis of an assumed own-price elasticity (percentage change in consumption from a 1% change in price) of demand for SSBs of -1.2 , which implies that a tax that raises SSB prices by 20% will result in a 24% reduction in quantity consumed. We assumed the 20% tax on SSBs was fully passed on to consumers (although evidence for alcohol excise taxes suggests some overshifting to consumers³⁹) and that all purchasers were subject to the same tax (including Supplemental Nutrition Assistance Program recipients).¹⁹ We assumed that average beverage prices were constant within and across states and that prices of non-SSBs did not change because of the tax.

We used 3 scenarios for calculating changes in consumers' non-SSB spending in response to the SSB tax; each accounted for the income effect associated with the tax. First, we did not explicitly model beverage substitution, instead allowing consumers to substitute other goods and services by increasing their disposable income by the amount equivalent to reduced beverage sales (minus tax paid on SSBs). We then used 2 methods for explicitly modeling beverage substitution. First, we assumed cross-price substitution to nontaxed beverages on the basis of a conservative cross-price elasticity of 0.1, implying that a 10% increase in the price of taxed beverages would increase consumption of nontaxed beverages by 1%.^{15,40–44} Next, we assumed that individuals would substitute other beverages with full-volume replacement of fluids on the basis of the distribution of the respective state beverage sales adjusted for tap water consumption (on the basis of data for individuals aged 2 years from the 2009–2010 National Health and Nutrition Examination Surveys). The full-volume replacement model provided an upper-bound estimate of beverage substitution assuming that consumers fully maintained their prior total beverage volume.

For both beverage substitution methods, we allocated the 27.8% margin of increased sales of substitute beverages to the retail industry

TABLE 1—Impact of 20% SSB Tax on SSB Sales Revenue and Government Revenue: Illinois and California, 2012

Variable	Illinois (\$ millions)	California (\$ millions)
Change in SSB sales revenue		
Total	-678.8	-1151.5
Soda	-402.3	-426.5
Fruit drinks	-100.0	-255.2
Isotonic beverages	-44.3	-149.7
Energy drinks	-36.2	-105.2
Ready-to-drink coffee	-12.7	-36.8
Ready-to-drink tea	-66.5	-142.1
Flavored or enhanced water	-16.8	-36.0
Change in government SSB tax revenue	554.3	940.4

Note. SSB = sugar-sweetened beverage. Calculations are based on the Regional Economic Models, Inc. model.

and the remainder to its respective manufacturing industry (soft drinks, fluid milk, or juice). This accounts for the differences in the labor intensity of retailing versus manufacturing. Finally, we allocated the calculated tax revenue from the 20% SSB tax (on the basis of the posttax sales volume) to the state-level government sector in the REMI model, which allocates revenue according to existing spending patterns, including public debt pay-

RESULTS

Table 1 reports the estimated effect of the 20% SSB tax on SSB sales and government revenue. SSB sales are estimated to decline by \$678.8 million in Illinois and \$1.2 billion in California. Regular soda is estimated to account for 59% of this reduction in Illinois and 37% in California. Government revenue from the SSB tax is estimated to be \$554.3 million in Illinois and \$940.4 million in California.

TABLE 2—Impact of 20% SSB Tax on Non-SSB Sales Revenue: Illinois and California, 2012

Variable	Illinois (\$ Millions)	California (\$ Millions)
Change in non-SSB sales revenue (on the basis of cross-price elasticity)		
Total	81.8	318.5
Diet soda	15.0	35.6
Diet ready-to-drink tea	2.5	11.9
Diet flavored or enhanced water	0.6	3.0
Fruit juice	14.0	37.1
Milk	25.9	60.9
Bottled water	23.8	170.1
Change in non-SSB sales revenue (on the basis of full-volume replacement)		
Total	364.3	612.3
Diet soda	66.6	68.5
Diet ready-to-drink tea	11.0	22.8
Diet flavored or enhanced water	2.8	5.7
Fruit juice	62.4	71.3
Milk	115.6	117.0
Bottled water	106.0	327.0

Note. SSB = sugar-sweetened beverage. Calculations are based on the Regional Economic Models, Inc. model.

Table 2 reports the estimated increased sales revenue from substitution with non-SSBs to be \$81.8 million in Illinois and \$318.5 million in California, on the basis of cross-price elasticity estimates, and \$365.3 million in Illinois and \$613.8 million in California, on the basis of full-volume beverage replacement.

Table 3 reports the employment results from the simulation analyses that account for the direct effect of reduced SSB consumption, the income effect among individuals with nonexplicit substitution, and the effect of government spending of new tax revenue. A 20% tax on SSBs is estimated to result in a net employment increase of 4406 jobs in Illinois and 6654 jobs in California. This is close to a zero net change in employment in both states, as it represents a 0.06% increase in jobs that would have existed without the tax in Illinois and a 0.03% increase in California.

Table 3 reports estimates that account only for reductions in SSB demand without accounting for either increased consumption of other goods and services or government spending of new tax revenue. These estimates suggest losses of 7002 jobs in Illinois and 14 992 jobs in California, representing 0.09% and 0.07% of jobs, respectively. This approach, which accounts only for the industry effect of reduced spending on SSBs, is the main basis for industry claims of large gross job losses in jurisdictions that adopt an SSB tax. Of these job losses, 1359 jobs in Illinois and 2306 jobs in California are estimated to be lost in the beverage manufacturing sector. After accounting for spending on other goods and services and government spending, job losses persist in the beverage industry. However, job losses in the private sector are almost completely reversed when we model all effects from the tax (Table 3).

Table 4 presents simulation results from scenarios that include explicit substitution to non-SSBs as a result of the tax-induced SSB price increase. In these cases, the direct impact on jobs in the beverage industry is smaller than when no explicit substitution is modeled, particularly for the scenario of full-volume replacement. Similarly, the direct impact on the retail sector (all retail trade) is smaller when beverage substitution occurs. Nonetheless, some jobs are transferred from the beverage industry to other parts of the economy. Even

TABLE 3—Impact of 20% SSB Tax on Total Jobs and Jobs in Selected Industries, Simulated Effects with Nonexplicit Beverage Substitution: Illinois and California, 2012

Jobs	SSB Industry Effect Only	SSB Industry, Income, and Nonexplicit Beverage Substitution Effects	SSB Industry, Income, Nonexplicit Substitution, and Government Effects
Illinois			
Total	-7002	-5979	4406
Private sector	-6450	-5506	-910
Beverage manufacturing	-1359	-1359	-1357
Retail trade	-2632	-2444	-1894
State and local government sector	-552	-474	5316
California			
Total	-14 992	-12 137	6654
Private sector	-13 695	-11 082	-248
Beverage manufacturing	-2306	-2303	-2294
Retail trade	-4359	-3926	-2722
State and local government sector	-1295	-1055	6902

Note. SSB = sugar-sweetened beverage. Calculations are based on the Regional Economic Models, Inc. model.

under the assumption of full-volume replacement, the employment level within the beverage industry is reduced (losses of 985 jobs in Illinois and 1453 jobs in California), because substituting tap water does not generate revenue for the beverage industry and substituting non-SSBs such as milk and 100% fruit juices feed into other industries and,

although still benefitting the regional economy, are not counted as part of jobs in the beverage industry.

DISCUSSION

We found that the imposition of a 20% tax on SSBs would result in a net employment

increase of 4406 jobs in Illinois and 6654 jobs in California, which is close to a zero net change (0.06% and 0.03% of jobs in those respective states). A key distinction of this study is that we report the net employment effect rather than the gross employment effect that industry highlights.

A recent study⁴⁵ funded and widely distributed by the American Beverage Association, including on its sponsored Web site (<http://www.nofoodtaxes.com>), concluded that a federal 10-cent tax on a 12-ounce serving of SSBs would cause the loss of approximately 210 000 jobs in the beverage industry and another 150 000 jobs in related industries. However, this industry-funded study did not account for reallocation of consumer spending on nonbeverage goods and services. Furthermore, it predicted a \$2 billion tax revenue loss, and it did not model the employment impact of increased government spending from new SSB tax revenues. A 10-cent per 12-ounce national SSB tax could raise \$1.15 billion in tax revenue.⁴⁶ Industry-funded consultants used similar arguments in formal testimony, for example, in opposition to California Senate Bill 1210, in which they argued that economic modeling suggests that there will be lost jobs, wages, and government tax revenue. Again these claims were predicated on gross, not net, effects from an SSB tax. Indeed, as noted by the principal developer of the REMI model, it is “incumbent on every user of a model to include the whole project in the model analysis.”^{32(p439)} In addition to arguments of job losses related to changes in consumption, the industry has discussed moving manufacturing plants out of states that impose a SSB tax.⁴⁸

There are a number of limitations in this study. First, we provided evidence for 2 states that may not be representative across the country. States with a greater presence of beverage manufacturing (i.e., where it contributes to jobs to a greater extent) may experience proportionately higher job losses. Nevertheless, the states we examined represented different regions, and findings for both were consistent. Second, we did not model effects related to improved health resulting from reduced SSB consumption, which can include lower health care and dental costs and improved labor market productivity. However, this makes the

TABLE 4—Impact of 20% SSB Tax on Total Jobs and Jobs in Selected Industries, Simulated Net Effects Including Industry, Income, Substitution, and Government Effects, by Alternative Substitution Scenarios: Illinois and California, 2012

Jobs	Net Effect With Nonexplicit SSB Substitution	Net Effect With Explicit SSB Substitution on the Basis of Cross-Price Elasticities	Net Effect With Explicit SSB Substitution on the Basis of Full-Volume Replacement
Illinois			
Total	4406	4509	4870
Private sector	-910	-814	-478
Beverage manufacturing	-1357	-1274	-985
Retail trade	-1894	-1706	-1054
State and local government sector	5316	5323	5348
California			
Total	6654	6252	5887
Private sector	-248	-617	-953
Beverage manufacturing	-2294	-1856	-1453
Retail trade	-2722	-2189	-1695
State and local government sector	6902	6869	6840

Note. SSB = sugar-sweetened beverage. Calculations are based on the Regional Economic Models, Inc. model.

results conservative. Third, we allocated tax revenue on the basis of existing state-level expenditure patterns. If a portion of the tax revenue is dedicated to health promotion, we can expect further improvements in health outcomes. Finally, using the existing REMI macroeconomic model limited how finely we could simulate the employment impact on the basis of the level of industrial disaggregation (i.e., the lowest industrial level available for several of our SSB categories was “soft drinks and ice”). However, this model allowed a comprehensive estimate of economic impacts on the basis of fully interactive systems of household, business, and government behavior.

It should be noted that in the absence of taxes, employment in the beverage industry has been falling. Although soft drink industry revenue (value of sales, shipments, receipts, revenue, or business transacted) increased by 64% from 1992 to 2007, the number of paid employees in the industry fell by 30% as the industry became less labor intensive.⁴⁹ Nonetheless, it is important to acknowledge that we predicted some SSB tax-related net job losses in the beverage industry. Estimated declines in beverage industry employment ranged from 985 to 1357 in Illinois and from 1453 to 2294 in California, depending on the extent of substitution to non-SSBs. However, new employment in nonbeverage industry and government sectors more than offset the declines in the beverage industry jobs found for Illinois and California. For example, truck drivers who previously delivered regular soda would transport other beverages, such as diet soda or bottled water, or other goods. It is important to note that our study findings do not imply that there would be no net job losses as a result of taxes imposed on other types of foods. Further research would be needed, for example, to assess the net impact on employment from a tax on fast food, a relatively more labor-intensive industry.⁴⁹

On the basis of the estimates for Illinois and California, SSB taxes would not have a negative impact on state-level employment. The industry claims of regional employment losses related to proposed SSB taxes are overstated and such claims may mislead lawmakers and constituents. ■

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Contributors

L. M. Powell conceptualized and designed the study, conducted analyses, interpreted results, and drafted and revised the article. R. Wada conducted simulation analyses, interpreted results, and assisted in drafting and revising the article. J. J. Persky contributed to the study design and the analyses and interpretation of results and critically reviewed the article. F. J. Chaloupka conceptualized the study, contributed to the design and interpretation of results, and critically reviewed the article.

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Human Participant Protection

No protocol approval was needed because this study did not include individual-level data.

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