

# Slim Odds

Empirical studies provide little evidence that soda taxes would shrink Americans' waistlines.

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Free lunches are hard to turn down for a city staring into the fiscal abyss. As it faces dwindling revenues and the increased demand for public services that usually accompanies a recession, Philadelphia, like most other U.S. cities, is looking for new ways to make a buck. However, with unemployment above 10 percent and a fear of providing even more excuses for businesses and more-affluent residents to flee for the suburbs, the city is not inclined to hike income and property taxes.

Spurred by this bleak outlook, Mayor Michael Nutter, like politicians in New York, California, and a host of other places, has hit upon an ingenious idea. Given that, among its other problems, Philadelphia is wrestling with a growing obesity epidemic, why not kill two birds with one stone and tax sodas? While taxing cheesesteaks or Tastykakes might lead to protests up and down Broad Street, a few additional cents' tax on each soda sold in the city holds the prospect of expanding the budget while trimming waistlines.

This double-dividend argument has been used before by public finance scholars in other contexts, from fossil fuels to alcohol. While almost all taxes are problematic because, in the process of

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raising revenues, they discourage a desirable activity, taxing "bad" activities supposedly generates cash flow while discouraging the underlying activity.

Unfortunately, like many free lunches, the health benefit from a soda tax is a mirage. Not only is the tax unlikely to generate much revenue as soda drinkers substitute away from the sugary beverages, most of the evidence suggests that they will substitute toward consuming other foods and beverages that are just as bad or worse for their health.

You would not know this, however, from how the research on this topic is presented in the media or, sometimes, by the researchers themselves. Uniformly, studies looking at the effect of actual soda taxes implemented at the state level find that, while the taxes do lead to a moderate decrease in soda consumption, the net effect on obesity is next to zero. Studies looking at data covering the full menu of consumption choices show that when people reduce their drinking of soda, they substitute to other calorie-dense drinks like milk and juice. Although not expressly examined in the consumption studies, it is also reasonable to assume that consumption patterns may change in other ways as well. For instance, adults may trade their Pepsi for a Pabst, while some individuals may decide that, because they stopped drinking Coke, they are free to eat more cake.

A comparable tax on all caloric intake might generate the health benefits policymakers seek. Eric Finkelstein, lead author of a study recently published in the *Archives of Internal Medicine*, asks rhetorically in a December 13, 2010 *USAToday* article, "Why single out sugar-sweetened beverages when cookies, candy, and other



products with lots of added sugar and fats are equally unhealthy, consumed in large quantities and very inexpensive partly due to generous farm subsidies?” Despite the desire to fight obesity, no politician can stomach high taxes on food across the board.

### What Do the Studies Find?

The most sophisticated research in this field using actual state soda taxes to identify the effect of such taxes on obesity is done by Jason Fletcher, an economist at the Yale School of Public Health, and co-authors. Fletcher et al. have examined the effects of taxes on consumption and ultimate weight effects for both adults and children. During the period 1989–2006, an average of 21 states taxed soda, with an average rate ranging from 4.1 to 5.1 percent. In a research paper published in the

*Journal of Public Economics*, Fletcher et al. used panel data methods to account for baseline differences across states (e.g., people are generally fatter in Pennsylvania than in Utah) as well as underlying national trends. Controlling for those factors, the researchers found that a one percent increase in the soda tax leads to a five percent reduction in calories consumed from sodas among young people age 3–18. While this result is statistically significant, Fletcher et al. call the reduction “modest” because sodas are only a small part of the average person’s total caloric intake.

Interestingly, the researchers did not find that the children substituted toward diet sodas or water, as is generally assumed by proponents of sugar-sweetened soda taxes. Instead, they found that the 6-calorie reduction in soda consumption is accompanied by an 8-calorie increase in milk consumption and a 2-calorie increase in juice and juice drink consumption. That is, any obesity-related benefit of decreased soda consumption that comes from a soda tax is, on average, more than offset by increased caloric consumption from other beverages. As expected, given these results, when the researchers directly examined data on the body mass index of the children in their dataset, they found no statistically significant effect of soda taxes on body weight or the likelihood of being obese or overweight. In fact, although the results are not

significant, they found a positive relationship between increases in soda taxes and these metrics.

Although Fletcher et al. are right to point out that the relatively low levels of taxes they examined make it impossible to reliably extrapolate their results to predict the effects of taxes on the order of 20–40 percent (a level suggested by soda tax advocates), their results suggest that such a policy would lead to modest increases in average BMI and the likelihood of being overweight or obese among children.

Using data for adults, Fletcher and his co-authors found a similar relationship, as they explain in an article published in the journal *Contemporary Economic Policy*. Specifically, they found no relationship between tax increases and changes in adult BMI or the likelihood an individual is overweight. This study examined nearly three million individuals, forming a nationally represen-

tative sample. Again, keeping in mind that there are significant problems in forecasting results outside of the range of taxes actually observed in the data (where the highest state tax on soda is below 8 percent), they conclude that even if the tax on soda were set at 58 percent — an amount 30 times the average soda tax in the United States — mean BMI would decline by less than 0.2 BMI points. That is, even with a tax that is substantially higher than what soda tax proponents advocate — a tax that is on par with the rate at which cigarettes are taxed — the obesity rate in the United States would decline by less than three quarters of a single percentage point.

**Other studies** | There are other studies using real-life data examining the relationship between soda consumption and weight. These studies are not as well done as the Fletcher et al. studies, primarily because they do not rely on the exogenous variation in soda consumption induced by taxes (i.e., by just looking at the relationship between how much someone drinks and his weight, it is not possible to rule out the possibility that people who drink a lot of soda might also tend to be fat for lots of other reasons, like lack of exercise). However, the other studies have gotten a lot of attention. Specifically, soda tax advocates and the media have cited the studies as supporting the idea that soda taxes could reduce obesity. Taking a closer look at the studies, however, suggests that the advocates have misinterpreted the results or, at the very least, they have put more weight on them than is justified.

For example, a paper by David Ludwig and co-authors, published in the *Lancet* in 2001, has been cited more than 1,000 times according to Google Scholar. This study followed 548 children, with an average age of 12 years old, living in four Massachusetts communities from 1995 to 1997. Ludwig et al. conclude, based on the data they collected, that increasing a child's consumption of sugar-sweetened drinks, including soda, by one serving per day is associated with a 60 percent increase in the likelihood a non-obese child will become obese.

While a 60 percent increase sounds large — and it no doubt is the reason advocates have embraced the study — the finding is misleading in a number of ways. First, an increase of one serving per day is a large change in consumption. In fact, it is more than four times the average change in consumption observed in the data. Using the Fletcher results discussed above, achieving this kind of increase in consumption would require at least a 20 percent price discount.

Another way to put this result in perspective is to note that an increase of one standard 12-ounce non-diet soda per day is larger than the entire increase in average non-diet soda consumption observed from the end of World War II through 2000. Simply put, the claim that an increase in sugar-sweetened beverage consumption is associated with a 60 percent increase in the likelihood of being obese is generated by positing an extraordinarily large increase in consumption. If, instead, Ludwig et al. had calculated the probability using an increase comparable to the increase in consumption they observed on average in their sample (0.22

servings), the associated increase in the probability of being obese would be only 12 percent. While their presentation is not wrong, it is certainly a more provocative way to frame the results — something that would be expected from activists, but not from scholarly researchers.

Perhaps more troubling, the Ludwig results themselves appear to either purposely or negligently ignore an important part of the data: almost as many children transitioned out of obesity from the start of the study to the follow-up period (35) as entered obesity (37). Ludwig's obesity analysis excluded all children who were obese at baseline. Presumably, it is just as interesting to analyze whether sugar-sweetened beverage consumption is associated with the transition out of obesity; another test of the basic hypothesis would be to see if those children who were no longer obese were also the children who reduced their consumption of sugar-sweetened beverages. The fact that this analysis was not done (or at least was not presented) leaves open the possibility that no such evidence exists, in which case the Ludwig et al. research simultaneously provides us with one confirmation and one refutation of the link between sugar-sweetened beverages and obesity. More generally, excluding the already-obese children (more than a quarter of the entire sample) when analyzing the determinants of obesity demands some explanation — especially since the rate of transitioning out of obesity in the sample is more than 2.5 times greater than the rate of transitioning into obesity. There is simply no way to know from the authors' analysis of their data what the total average effect of sugar-sweetened beverages is on the incidence of obesity in children because Ludwig et al. ignored at least half of the story. Despite this glaring omission, their research is cited nearly every time a soda tax is suggested.

Another problem, not with the study per se but with its use to push for soda taxes as a way to combat obesity, is the authors' failure to recognize that the consumption of sugar-sweetened beverages explains a very tiny fraction of the BMI increase observed in their study. The authors estimate that a one-beverage-per-day increase in consumption leads to a 0.24-point increase in BMI. However, the actual average increase in consumption was only 0.22 servings, producing an average BMI increase of just 0.05 points. But overall, the average increase in BMI was 1.5 points over the 19 months of the study, which means that sugar-sweetened beverage consumption accounted for less than 4 percent of weight gain. The vast bulk of the weight gain in the period was entirely unrelated to beverage consumption.

Other research using similar designs on broader samples of children find comparably small effects. A study by Catherine Berkey et al. published in 2004 in the journal *Obesity Research*, for example, found effects that were even smaller than those estimated by Ludwig. Specifically, the study found that an increase of one additional serving of sugar-sweetened beverages per day was associated with an increase in BMI of less than 0.03 points. Numerous other studies find results somewhere in this range.

Despite the trivial importance of soda consumption in the growing obesity epidemic, advocates still claim that research supports the case for soda taxes. Writing an opinion piece in

2009 in the *New England Journal of Medicine*, Kelly Brownell, a Yale professor and director of the Rudd Center for Food Policy and Obesity, and Thomas Frieden, New York City health commissioner, asserted, “Sugar-sweetened [beverages] ... may be the single largest driver of the obesity epidemic.” Such claims are hard to square with the evidence.

### When Empirical Data Don’t Work, Resort to Simulations

A lack of direct evidence on the relationship between changes in soda consumption and BMI has not stopped some researchers from making heady claims based on simulated price changes. Specifically, a number of researchers have developed models leading them to claim that large taxes on sugar-sweetened beverages would lead to substantial reductions in BMI.

The general approach of these studies is to use consumption data for a handful of beverages to estimate a demand function for those beverages. Using the price elasticities from these models, including any substitution that occurs among the beverages, the researchers then ask what the implied calorie reduction would be from a given tax increase. Using this information, the researchers translate the calorie reductions into weight loss based on standard assumptions converting calories to body weight changes.

Finkelstein et al., in their 2010 *Archives of Internal Medicine* paper, used this approach to predict that a 40 percent tax on sugar-sweetened beverages would lead to weight loss implying an average BMI reduction of 0.2 points per year. A team from the U.S. Department of Agriculture released the report “Taxing Caloric Sweetened Beverages” earlier in 2010 that takes a similar approach. The USDA team predicted that a tax-induced 20 percent increase in the price of sugar-sweetened beverages would lead to a BMI reduction of 0.6 points on average per year for adults, while having an even greater effect on children.

In both of these studies, the researchers claim that by accounting for substitution to other beverages — that is, by estimating the cross-price elasticities between sugar-sweetened beverages and other beverages like milk and diet soda — their simulations can provide accurate assessments of the net effect of beverage taxes on body weight. But if this is so, why do studies examining the effects of actual price changes on body weight find effects that are so much smaller?

The simulations generate larger effects because they assume tax increases that are quite large relative to the price variation they observe in the data. As a general rule, extrapolating estimates beyond the range of the data can be quite problematic and resulting forecasts are often unreliable. Another problem with the simulations, as opposed to observing effects on weight directly, is that the simulations will only be accurate if the model sufficiently controls for all avenues of substitution. If substitution occurs into beverages not included in the model, forecasts that do not take this into account are guaranteed to be biased. While both studies described above allow for substitution into beverages like milk or juice, neither includes beverages like chocolate milk,

beer, wine, or alcoholic beverages, each of which is more calorie-dense than the included beverages. Further, neither of the studies allows for the possibility that substitution occurs from beverages to foods. If individuals replace avoided calories by eating more, these simulations will generate estimates of BMI decreases that are too large.

While we do not know for sure if substitution occurs along these other channels, the results from the studies that directly observe body weight changes when beverage prices change should lead people to be skeptical of the simulation results. Despite this, in the *USAToday* article on the Finkelstein simulation study, Brownell suggests the study shows that taxes could significantly improve public health.

### You Can’t Have It Both Ways, But Sometimes You Can Have It Neither Way

While politicians at all levels of government in the United States have been drawn to soda taxes as a way to both raise money and fight obesity, the evidence suggests that taxes may in fact do neither. Yes, individuals do seem to be price sensitive when it comes to soda and other sugar-sweetened beverages. That implies, however, that any increase in tax rates will be offset largely by declining demand for soda specifically, but not for calorie-rich foods overall. While many public health advocates grab on to any indication of price sensitivity to support taxes as a way to reverse the upward trend of obesity, no study finds that this effect is very large in terms of the ultimate effect on body weight, as individuals substitute to consuming other calorie-dense beverages, adjust their eating habits in ways that have little net effect on BMI, or generally undo the positive effects of reduced soda consumption. **R**

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