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# BETTER MILK THAN COLA: SOFT DRINK TAXES AND SUBSTITUTION EFFECTS

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*This article is part of a series of Policy Issues articles on Soda Tax. You can also find articles on Should Soft Drinks be Taxed More Heavily?, Can Taxing Sugary Soda Influence Consumption and Avoid Unanticipated Consequences?, Sugar-Sweetened Beverage Taxation as Public Health Policy-Lesson from Tobacco, Soda Taxes and Substitution Effects: Will Obesity be Affected?, Evaluating Excise Taxes: The Need to Consider Brand Advertising, and Caloric Sweetened Beverage Taxes: The Good/Food/Bad Food Trap as part of this theme.*

Soft drink excise taxes and the effect they may have on adolescent weight outcomes have come into focus as a potential policy option to address the obesity epidemic, which is increasingly recognized as a major contributor to health care spending and mortality and morbidity (Bhattacharya and Sood, 2011). U.S. sugar-sweetened sodas account for one-half of the increase in caloric consumption over the past 25 years, and are the largest source of added sugars in the average diet (Woodward-Lopez, Kao, and Ritchie, 2010). Barry M. Popkin, at the University of North Carolina's School of Public Health, has advocated aggressive policy interventions to reduce consumption of sweetened sodas to address the obesity crisis (Popkin, et al., 2006).

Recent econometric evidence suggests that increasing soft drink taxes will cause substitutions toward other beverages, although there is not agreement about the net health effects these policies will have. We offer a perspective on the economic and public policy interpretations of soda taxes that suggests a greater potential for reducing obesity and improving health. To assess the full effect of such policy options, economic theory and econometric evidence must be considered in the context of nutritional and metabolic effects.

### Substitution Effects and Caloric Intake

At a theoretical level, assessing sin taxes on consumption goods that are likely to be consumed at unhealthy levels has been carefully considered. O'Donoghue and Rabin (2006) show that such taxes can improve social welfare, counteract over-consumption by consumers who cannot restrain their behavior effectively, and even result in outcomes where no one is made worse off. However, they warn that when goods such as soda are taxed, policymakers should not ignore the substitution of other, non-taxed goods.

Econometric analysis of these substitution effects (Fletcher, Frisvold, and Tefft, 2010) supports the claim that soft drink taxes would 1) raise revenues; 2) modestly reduce the amount of soda calories consumed; 3) induce the substitution of juice and whole milk for soft drinks; and (4) reduce caffeine consumption. Notably, they concluded that a change in the soft drink tax rate induces youths to substitute whole milk for soft drinks and, because "the magnitude of these effects is similar, it is not likely that an increase in soft drink taxes would decrease obesity" (p. 7). Specifically, using data from the National Center for Health Statistics of the CDC from 1989 to 2006, they found that a 1% tax on youth consumption of soft drinks reduces soda consumption by 6 calories, about 5% of average soda calories consumed daily. However, if such a tax rose to 16%, calories from soda were predicted to fall by 100 per day. This would be sufficient, according to Hill, et al. (2003), to prevent weight gain in over 90% of the population—but only if it was not offset by substitute caloric intake. Yet such substitutions are likely, with small increases in juice and larger increases in whole milk. In the Fletcher, et al. study, a 1% increase in soft drink taxes induces an 8-calorie increase in whole milk consumption per day. A 12 oz. can of soda contains 140 calories, but 12 oz. of whole milk contains 219 calories. This substitution results in slight increases in vitamin D consumption from milk and slight decreases in caffeine consumption.

**Public Policy Implications**

Even if the substitution of juice and milk does not reduce caloric intake as a result of a soda tax, there is a different perspective on the economic interpretation of the findings on substitution effects and their implications for public policy. One thing is clear: such taxes will dampen soda consumption. A 2010 study by USDA concluded that a tax-induced 20% price increase on sweetened beverages would reduce consumption by 37 calories a day, or 3.8 pounds of body weight over a year for adults, and by 43 calories a day, or 4.5 pounds a year for children. The result would be an estimated decline in overweight prevalence from 66.9% to 62.4% and obesity prevalence from 33.4% to 30.4% in adults. In children, overweight prevalence would fall from 16.6% to 13.7%, and the risk of being overweight would fall from 32.3% to 27.0% (Smith, Lin, and Lee, 2010). The decline in demand for soda in response to such a tax is reinforced by three other studies (Block, et al., 2010; Brownell, et al., 2009; and Power and Chaloupka, 2009). Soda taxes alone would then represent progress in reducing consumption of products that are a major cause of weight gain (Malik, Schulze, and Hu, 2006; and Vartanian, Schwartz, and Brownell, 2007). As a recent and comprehensive review by the Public Health Law Center at the William Mitchell College of Law concluded: "While reducing the consumption of these beverages will not single-handedly halt the obesity epidemic in the United States, growing evidence supports the use of pricing policies on sugar drinks as one of the most significant components of a comprehensive effort to reduce the prevalence of obesity and unhealthy weight" (Marrow, 2011, p. 20).

There are also reasons why milk-substitution responses, in particular, offer substantial improvements over the status quo and may actually assist in reducing obesity. First, milk consumption in lieu of soft drinks offers clear nutritional advantages, especially in children and young adults. Second, calories alone do not capture the metabolic effects of soft drinks, which are deemed by some experts to promote obesity, hypertension and Type II diabetes in ways that milk does not (Malik, et al., 2010). Third, nearly all of the milk consumed in schools is now 2%, 1% or skim, with fewer calories and less fat than whole milk. Fourth, levels of satiation are lower for milk than soda, so that children and teenagers will become full at lower amounts.

Milk's nutritional value is high; it contains proteins, minerals—Ca, P, Mg, Na, Zn, Cl, Fe and Cu, among others—and vitamins A, C and D. Humans have coevolved with bovine species to digest it—apart from the lactose intolerant—over thousands of years. By contrast, soda is devoid of protein, vitamins and minerals—apart from salt (Na): the average 12 oz. soft drink contains 50 grams (Robus, 2010). Although soda drinks have been with us for only about 100 years, it is notable that 30 years ago, U.S. middle and high school students consumed twice as much milk as soda; now, the ratio is reversed: students consume twice as much soda as milk (Cavadini, Siega-Riz, and Popkin, 2000).

Calories alone do not fully capture the metabolic effects of soft drinks. Fructose-laden soft drinks are digested similarly to alcohol and converted to fat by the liver, increasing triglycerides in the bloodstream. They also reduce the production of leptin, which normally signals the body to reduce caloric intake and increase energy output. They increase the dopamine reward response, making soda drinkers hungrier, while increasing cortisal release, lowering insulin resistance (Mietus-Snyder and Lustig, 2008; and Wylie-Rosett, Segal-Isaacson, and Segal-Isaacson, 2004). The University of California-San Francisco Center for Obesity sends obese children and their parents home with the admonition: "drink only water and milk." As milk consumption has given way to soda, Vitamin D consumption has fallen together with calcium. In addition, phosphoric acid in sodas appears to interfere with calcium absorption and contributed to a three-fold increase in bone fractures in samples of soda-drinking teens (Wyshak, 2000).

Federal law—Section 202 of the 2010 Healthy, Hunger-Free Kids Act—requires that schools offer a variety of fluid milk products consistent with dietary guidelines including the 2007 Institute of Medicine standards for food in schools, recommending unflavored non-fat and low-fat milk. This means that whole milk, the main basis of claims that its substitution will not reduce obesity, is no longer served in most schools. Although chocolate and other flavored milks are often dosed with fructose, plain milk in schools is generally 2%, 1% or skim. Although a 12 oz. serving of whole milk contains about 220 calories, 2% has 183 calories, 1% has 153 calories and skim milk has 135 calories. Substituting reduced-fat milk for soda retains nearly all of the nutritional value of milk while reducing its lipid triglycerides.

Finally, fructose-sweetened soft drinks do not trigger a pituitary satiety—ghrelin—response; they actually do the opposite (Lustig, 2009). Milk, by contrast, appears to have a built-in satiety brake. Its digestion occurs when acids cause it to curdle in the stomach (University of Guelph, 2010). Lactose—milk sugar—must be processed with the enzyme lactase, which even in lactose-tolerant people is available only in sufficient quantity to digest about one or two glasses of milk over several hours. The calcium in milk is neutralized by stomach acids during curdling, but the main brake on milk consumption is that a 12 oz. glass of milk contains 450 mg of calcium. Shahar, et al. (2010) report that higher intakes of dairy calcium and vitamin D are actually related to greater diet-induced weight loss. Dove, et al.

(2009) report that skim milk leads to greater perceptions of satiety and fewer calories consumed at the next meal compared with fruit drinks. In the latest and most comprehensive assessment of 120,877 participants in the Nurses Health Study, Nurses Health Study II and Health Professionals Study, over a 12- to 13-year period, increases in dairy product intake had a neutral effect on weight (Mozaffarian, et al., 2011).

**Excise Taxes Appear to Be Good Policy**

Taxing soda will reduce its consumption and raise revenue; by one recent estimate a 1 cent/oz. national U.S. excise tax would cut soda calorie consumption 8-10% and raise $15 billion per year (Brownell, et al., 2009). Moreover, from a theoretical perspective, the cross-subsidization from non-consumers of soft drinks to consumers resulting from such a tax is not large, and both classes of consumers can be shown to be better off (O'Donoghue and Rabin, 2006). Even if the caloric reduction in soft drinks is offset by whole milk consumption, the nutritional and metabolic advantages of milk versus soda are clear. If such consumption is of plain, reduced-fat milk, these advantages are amplified. Finally, a 1-for-1 substitution of milk for soda on a per volume basis is unlikely, due to milk's digestibility relative to soda. For these reasons, wide adoption of such excise taxes appears to be good policy. Even if they fail to reduce caloric intake in young people, the quality of those calories will improve.

**For More Information**


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