RWJF Scholars in Health Policy Research Program

The Effects of Soft Drink Taxes on Child and Adolescent Consumption and Weight Outcomes

Jason M. Fletcher
David Frisvold
Nathan Tefft

August 2009
Working Paper Series

WP-44

Preparation and dissemination of this working paper series was assisted by a grant from The Robert Wood Johnson Foundation Princeton, New Jersey

Comments Welcome – Please address comments to David Frisvold at david.frisvold@emory.edu

The Effects of Soft Drink Taxes on Child and Adolescent Consumption and Weight Outcomes[*]

Jason M. Fletcher[†], David Frisvold[‡] and Nathan Tefft[§]

August 26, 2009

Abstract

Childhood and adolescent obesity is associated with serious lifetime health consequences and has seen a recent rapid increase in prevalence. Soft drink consumption has also expanded rapidly, so much so that soft drinks are currently the largest single contributors to energy intake. In this paper, we investigate the potential for soft drink taxes to combat rising levels of adolescent obesity through a reduction in consumption. Our results, based on state soft drink sales and excise tax information between 1988 and 2006 and the National Health Examination and Nutrition Survey, suggest that soft drink taxation, as currently practiced in the United States, leads to a moderate reduction in soft drink consumption by children and adolescents. However, we show that this reduction in soda consumption is completely offset by increases in consumption of other high calorie drinks.

JEL classification codes: I18; H75

Keywords: Obesity; Soft Drink Taxation

---

[*] This study was supported, in part, by the Robert Wood Johnson Foundation and the Emory Global Health Institute. We thank Jeremy Green, Alejandra Carrillo Roa, and John Zimmerman for excellent research assistance. We thank Alexandra Ehrlich and Stephanie Robinson for support with the restricted NHANES data. We also thank Meena Fernandes and participants at the International Health Economics Association World Congress for helpful comments.

[†] School of Public Health, Division of Health Policy and Administration, Yale University, 60 College Street, New Haven, CT 06510, USA, email: jason.fletcher@yale.edu.

[‡] Department of Economics, Emory University, Atlanta, GA 30322-2240, USA, email: david.frisvold@emory.edu.

[§] Department of Economics, Bates College, 4 Andrews Road, Lewiston, ME 04240, email: ntefft@bates.edu.

Introduction

While soft drink taxes have been used for decades as a way to raise revenues, lately there have been an increasing number of proposals to considerably increase these taxes in order to combat the rapidly growing obesity epidemic in the United States. These proposals have often framed soda taxation as a "sin tax" and made comparisons between soft drink taxation and cigarette taxation, which has both lowered tobacco consumption and raised considerable revenues. The price elasticity for soda is estimated to range between -0.8 and -1.0 (Andreyeva et al. in press), which indicates that further taxation could lead to substantial consumption reduction. Additionally, soft drink revenues in the United States are approximately $70.1 billion per year, suggesting a relatively large tax revenue potential, even accounting for the drop in consumption from a soda tax (Sicher 2007); in comparison tobacco revenues are approximately $93.1 billion per year (Tobacco-NAFTA Industry Guide 2009). Thus soft drink taxation could improve health by lowering consumption, as well as generate substantial revenues to relax government budget constraints and could potentially be used for further obesity prevention or reduction. However, the potential behavioral responses to increasing soda taxes have not been fully examined. There is relatively weak information on the tax elasticity on consumption of soft drink taxes, and, importantly, the substitution patterns between soft drinks and other (potentially high-calorie) beverages has not been adequately explored in this context. Thus soda taxes could have unintended consequences and may be an ineffective "obesity tax".

There are multiple examples documenting how behavioral responses to public policies can counteract the intent of the policies or lead to unintended consequences. One of the best known examples in the economics literature is an evaluation of a set of automobile safety regulations in the late 1960s, where Peltzman (1975) shows that drivers responded to increased

safety regulations by driving faster, which completely offset any reductions in highway fatalities. More recently, Adams and Cotti (2008) show that smoking bans in bars have lead to increases in fatal accidents due to an increase in the distance driven to bars that allow smoking. Adda and Cornaglia (in press) find that smoking bans increase the exposure of non-smokers to tobacco smoke as a result of the relocation of smokers away from bars and restaurants. There is also some evidence documenting an unintended rise in obesity and weight due to smoking bans (Fletcher 2009) and higher cigarettes taxes, although there is mixed evidence on taxes (Chou et al. 2004, 2006, Gruber and Frakes 2006, Baum 2009). Courtemanche (in press) seeks to harmonize these disparate findings and has shown a counterintuitive reduction in obesity following cigarette taxation, where the proposed behavioral mechanisms are through changes in exercise and food consumption. Additionally, Evans and Farrelly (1998) find that smokers respond to higher cigarette taxes by smoking cigarettes with higher tar and nicotine content. Similarly, Adda and Cornaglia (2006) find that smokers adjust their behavior to smoke more intensely in response to higher taxes. Finally, recent theoretical and simulation research by Schroeter, Lusk, and Tyner (2008) shows there are plausible scenarios where taxes on certain types of food (e.g. food away from home) could lead to *increases* in body weight simply due to substitution among types of food. Likewise, soda taxes could cause substitution to other, high calorie beverages and increase or have no effect on net caloric intake. In the extreme, these potential substitution patterns could result in a case where individuals consume no soda but offset soda consumption with other high calorie beverages, such as fruit juice, juice drinks, or whole milk. The impact of these behavioral responses would be no tax revenues as well as no weight reduction and the policy would accomplish neither of its proposed goals.

In this paper we combine newly collected soft drink tax data between 1988 and 2006 with the restricted-access version of the nationally representative National Health Examination and Nutrition Survey (NHANES) in order to examine the effects of soft drink taxes on child and adolescent soft drink consumption, substitution patterns, and weight outcomes. We use standard empirical specifications from the cigarette taxation literature (Chaloupka and Warner, 2000), including year and state fixed effects, and conduct a series of robustness checks to increase confidence in the results. Overall, we find evidence of moderate reductions in soft drink consumption from current soda tax rates. However, we also show that reductions in calories from soda are completely offset by increases in calories from other beverages. Thus, we find that, as currently practiced, soda taxes do not reduce weight in children and adolescents and is, therefore, likely an ineffective "obesity tax". These results suggest that public health policymakers should consider behavioral responses when crafting policies to reduce obesity.

Background Literature

The rise in childhood and adolescent obesity in the US and other developed countries has been the source of considerable debate and public policy effort. The effects of obesity on chronic health conditions have been compared to the effects of aging twenty years in adults, and the health costs associated with obesity are even greater than two other behaviors widely recognized to cause significant harm: cigarette smoking and alcohol consumption (Sturm, 2002). Since childhood and adolescent obesity may increase the risk of adult obesity (Nader et al., 2006), prevention, rather than treatment, of adult obesity may be the more effective tool in limiting lifetime health care costs. Finkelstein et al. (2009) estimate that the medical costs attributable to obesity were as high as $147 billion in 2008, which is nearly 10% of all medical

spending nationally. The additional medical costs of obesity represent an externality because the obese do not fully pay for their higher costs within pooled health insurance and public health insurance programs and because being insured increases obesity (Bhattacharya et al. 2009). There have been many efforts at reducing the burden of obesity, some focus on food prices and advertising (Chou, Rashad, and Grossman 2005) and others highlight the need to increase exercise opportunities (Cawley, Meyerhoefer, and Newhouse 2007). Recently, there have been a large number of proposals that focus on reducing consumption of products with little nutritional value, such as soft drinks.

Soft drinks were the single largest contributor to energy intake during the last decade (7%) (Block 2004) and soft drink consumption increased by almost 500% during the past 50 years (Putnam and Allshouse 1999). While soft drinks are a large and growing category of caloric intake, it may be unclear whether focusing on a single class of consumption can lead to weight change. In fact, there is emerging evidence that small net changes in caloric consumption can lead to substantial changes in the prevalence of obesity over time (Cutler, Glaeser, and Shapiro, 2003). For example, Hill et al. (2003) suggest that reducing energy intake by only 100 calories per day, which is less than one fewer can of soda per day, could prevent weight gain in over 90% of the population. Ludwig et al. (2001) demonstrate that consuming one additional sugary drink per day over a period of eighteen months increased the odds of being obese in children by 60%. Harnack, Stang, and Story (1999) find that total energy intake is positively associated with the consumption of nondiet soft drinks. Thus, it may be possible to effectively reduce weight by targeting a single food item.

A policy that has garnered recent attention as a possible method for reducing weight and thus improving health is a tax on soft drinks.[1] The taxation of soft drinks by states, which dates back to at least 1920 (New York Times, 1920), has historically been used to raise revenue (Caraher and Cowburn, 2005). Recently, however, taxes on soft drinks have been proposed at federal, state, and local levels as an indirect tax to reduce obesity, while continuing to raise revenue (Chouinard et al., 2007; Brownell and Frieden, 2009). For example, in May 2009 the Center for Science in the Public Interest planned to propose a federal excise tax on sweetened soft drinks and other beverages.[2] Brownell and Frieden (2009) suggest a tax equal to a penny per ounce, which is larger than all prior taxes on soft drinks, to our knowledge. Governor David Paterson of New York proposed an "obesity tax" in December 2008, which consisted of an 18% tax on sugared beverages.[3] [4]

These tax proposals have been offered with little evidence to assess their potential effectiveness. In fact, most of the rigorous evidence that exists appears to suggest limited effectiveness. For example, in the context of adult outcomes, Fletcher, Frisvold, and Tefft (in press) use repeated cross sections of the Behavioral Risk Factor Surveillance System (BRFSS) data combined with state and year fixed effects to show that the reduced from effect of soft drink taxes on adult weight is negligible. The reduced form approach was unable, though, to shed light on whether there were consumption responses to taxation.[5]

---

[1] See Chriqui et al (2008) for an overview of U.S. soft drink taxes in 2007.
[2] http://online.wsj.com/article/SB124208505896608647.html#mod=rss_Health (last accessed May 12, 2009)
[3] http://www.cnn.com/2008/HEALTH/12/18/paterson.obesity/ (last accessed May 11, 2009)
[4] In addition to attempting to reduce obesity, the goals of these proposals were also to raise revenue. The tax in New York was proposed to raise revenues to help balance the state budget and the Center for Science in the Public Interest proposed to raise revenues to pay for national health care reform.
[5] Powell, Chriqui, and Chaloupka (2009) also take a reduced form approach and focus on adolescent weight. Like Fletcher et al. (in press), they find no evidence of reduced form effects on adolescent weight. However, the interpretation of their results is unclear because they are unable to control for unobserved state-level characteristics that could be correlated with soft drink taxes. They also are only able to examine a small set of ages (8th, 10th, and

While the current evidence suggests no effects from soft drink taxation on adult weight, it is possible that there may be differential effects of soda taxation on children. For example, Chaloupka et al. (2000) review multiple studies of cigarette price elasticity, noting that youth have often been found to be more responsive to price than adults (although these conclusions are complicated by the fact that youth are also subject to access restrictions). One explanation for this possibility is that children and adolescents may spend a larger share of their budget on soft drinks than adults or households and are therefore more responsive to changes in price. If youth exhibit a relatively strong price response as in the case of cigarette consumption, policies that moderately change soft drink prices could lead to substantial declines in obesity over time among children and adolescents.

Conceptual and Empirical Framework

We conceptualize the demand for soft drinks by child *i* in state *s* as a function of individual and family socio-demographic characteristics (*X*), household income (*I*), and the prices of soda (P_s) and other beverages (P_o):

$$soda_{is} = f\left(P_s(\tau_s), P_o, X_i, I_i\right), \qquad (1)$$

where soft drink prices are a function of soft drink taxes imposed by the state (τ_s). Our focus in this paper is estimating the effects on soda consumption and weight from increasing soda tax rates.[6] But in order to gain a complete understanding of the effects, it is useful to recall the decomposition of the effects:

$$\frac{\partial soda_{is}}{\partial \tau_s} = \frac{\partial soda_{is}}{\partial P_s}\frac{\partial P_s}{\partial \tau_s}, \qquad (2)$$

12th graders), and can provide no evidence of whether adolescents are price sensitive in their soda consumption decisions.

[6] We assume the income effect is unimportant in these decisions.

where $\frac{\partial soda_{is}}{\partial P_s}$ is the price elasticity of demand of soda and $\frac{\partial P_s}{\partial \tau_s}$ is the proportion of tax pass-through or shifting from suppliers to consumers. Because we do not have adequate price data for the individuals in this sample and because price is endogenous in demand analysis (Gruber and Frakes 2006), we focus on the reduced form effects of (exogenous) taxes on consumption. Before presenting our empirical model, we outline what is known about the two components of the reduced form estimates. This discussion also highlights the uncertainty of calculating consumption responses when not using evidence from direct tax effects.

Estimates of the price elasticity of demand for soft drinks are available, but there does not seem to be a consensus. While a recent survey of the literature suggest typical price elasticities of -0.8 to -1.0 (Andreyeva et al. in press), more recent examples of compensated price elasticity estimates range from -0.15 (Zheng and Kaiser, 2008) to -1.90 (Dharmasena and Capps, 2009). The differences in estimates are, in part, due to the specificity of food and drink categories that might be considered candidates for complements or substitutes. In any case, there is a relatively large range of uncertainty for policy makers to predict demand responses to price changes given the evidence accumulated thus far.

In addition to the uncertainty surrounding price elasticities, there is scant evidence on how soft drink taxes might affect behavior through prices. Since policy makers often do not set prices directly, they must rely on indirect methods such as taxation. Kotlikoff and Summers (1987) describe the theory of tax incidence and show that tax *shifting*, or the proportion of a tax that is reflected by a change in price, varies by market. In fact, Besley and Rosen (1999) show that the change in soft drink price *exceeds* a tax change by 29 percent and suggest that this

*over*shifting of the tax burden is the result of imperfect competition in the soft drink industry.[7] Overall, however, as a result of the recent changes in states' soft drink taxes, additional work is needed in this area.

Even after establishing the effect of taxes on consumption behavior through prices, the further question remains regarding how effectively reducing soft drink consumption will improve child weight and obesity prevalence. In fact, if youths reduce their consumption of caloric and non-caloric soft drinks in response to a tax but increase their consumption of non-taxed high calorie beverages such as juice or whole milk, then a tax on soft drinks could actually *increase* weight (Schroeter, Lusk, and Tyner, 2008). For example, while a 12 ounces can of soda contains 140 calories, 12 ounces of whole milk contains 225 calories. The empirical uncertainty surrounding soft drink price elasticity and tax shifting combined with the theoretical ambiguity of the effect of soft drink taxes on obesity warrants an analysis of the direct tax effects on both consumption and weight outcomes when considering the dual policy goals of revenue generation and child health.

Empirical Framework

Our empirical strategy regarding soft drink taxes follows the literature on cigarette taxation (Chaloupka and Warner, 2000) and work examining adult BMI (Fletcher, Frisvold, and Tefft, 2009) by estimating state and year fixed effects models using the repeated cross-sections of the NHANES datasets. Specifically, we estimate the empirical models,

$$Y_{istq} = \beta_1' X_{istq} + \beta_2 T_{stq} + \mu_s + \delta_t + \gamma_q + \varepsilon_{istq}, \quad (1)$$

where Y_{istq} is the consumption or weight outcome of individual *i* in state *s* in year *t* in quarter *q*, which is determined by individual and environmental characteristics (X_{istq}), the soft drink tax in

[7] Kenkel (2005) also finds evidence of overshifting between alcohol taxes and prices.

state *s* in year *t* in quarter *q* (T_{stq}), and state, year, and quarter of year fixed effects.[8] Using this strategy, the impacts of soft drink tax rates are identified from changes in the tax rate within states over time. To estimate the direct impact of soft drink taxes on soda consumption, we examine whether any soft drinks are consumed, the amount of calories from soft drinks, and the total grams of soft drinks that are consumed. To estimate whether children respond to soft drink taxes by changing their consumption of other beverages, we examine the amount of calories consumed from juice, juice-related drinks, and whole milk. To estimate the impact of soft drink taxes on weight outcomes, we examine an age and sex-specific normalized measure of body mass index and the weight classifications of obese, overweight, and underweight.

A limitation of this strategy is the potential that unobserved characteristics that vary within states and over time are related to soft drink taxes and BMI. To address this limitation, we estimate additional specifications that also include variables that measure state economic and health conditions.

Data

Soft Drink Taxes

States currently tax soft drinks through excise taxes, sales taxes, and special exceptions to food exemptions from sales taxes. For this paper, we define the soft drink tax as the tax on soft drinks net of taxes on other food items.

To determine the soft drink tax rate, we combine sales tax information with details on other soft drink taxes. The "Book of the States" (The Council of State Governments, 1990-2007) is used to identify state sales tax information. Published annually, it lists tax information

[8] With our relatively short panels of states (1988-1994 and 1999-2006) and because not every state is included in the survey in every year, we do not include state-specific time trends in our preferred results, but we do perform several robustness checks outlined below.

and whether each state has a sales tax food exemption. This resource, LexisNexis Academic, and state departments of revenue web sites allow us to compile state sales tax rates and effective food tax rates by quarter. To understand how states tax soft drinks, we conduct further research with the above resources. Using LexisNexis Academic and departments of revenue web sites, we are able to determine if soft drinks fall under food exemptions, or if they are taxed wholly or additionally by sales or excise taxes.

We convert all tax descriptions such that they may be incorporated into tax rates.[9] For taxes that are quoted in dollars per quantity, we convert any level tax into a percent of expenditure using the Bureau of Labor Statistics annual nationwide price index for a quantity of soda. We do not include taxes on soft drink syrups because we do not have information on the expected amount of syrup per quantity of soft drink.

Using the effective dates of each tax, we are able to combine information on excise taxes and sales taxes to calculate quarterly soft drink tax rates for each state. We confirm this data collection effort by comparing with soft drink tax descriptions in Jacobson and Brownell (2000) and Chriqui et al. (2008).

Table 1 shows the average annual tax rates across all states for 1988 through 2006. The average soft drink tax rate varies between 1.5 and 2.3 percent during this period. The number of states with any tax on soft drinks in each year varies between 19 and 24 and, among states with a tax, the average rate varies between 4.1 and 5.1 percent. Also, there were 53 tax rate changes within states over time.

NHANES

[9] "Soft drinks" are commonly defined similarly across states, although this is not always true. They are often defined broadly to include non-alcoholic, artificially sweetened or "diet" drinks, and carbonated water.

The NHANES surveys are administered by the National Center for Health Statistics (NCHS) of the CDC to assess the health and nutritional status of the civilian, non-institutionalized population of the United States using a complex, multistage probability sample design. NHANES III includes nearly 34,000 respondents and was conducted between 1988 and 1994. In 1999, the NHANES program changed to consist of a nationally representative sample of about 5,000 persons each year; however, the sampling design remained similar to NHANES III. Of these recent surveys, we will utilize information from 1999 to 2006.

NHANES data is collected through survey questionnaires and physical examinations that occur primarily in a mobile examination center. Importantly for this analysis, the NHANES data contain information on body mass index (BMI), youth's soft drink and other beverage consumption, and demographic characteristics. Additionally, state of residence information is available through the NCHS Restricted Data Center, which allows us to merge our state-level tax information with the individual level data.

Height and weight were measured by trained health technicians during the physical examinations and BMI was calculated as weight in kilograms divided by height in meters squared. We construct dichotomous measures of obese (BMI $\geq 95^{th}$ percentile of the historical age of month- and sex-specific distribution), overweight and obese (which we call overweight throughout the text) (BMI $\geq 85^{th}$ percentile), and underweight (BMI $< 5^{th}$ percentile) and the continuous measure of BMI z-score[10] from BMI for all individuals between the ages of 3 and 18 using the sex-specific BMI for age thresholds from the 2000 CDC Growth Charts.

[10] The BMI z-score for an individual is calculated as the BMI minus the mean BMI of the reference population, which is then divided by the standard deviation of the reference population, where the reference population is all individuals of the same sex and month of age. Thus, the units of the BMI z-score are standard deviations from the mean.

During the physical examinations, survey respondents completed a 24-hour dietary recall with a trained dietary interviewer that detailed all foods and beverages, except water, that were consumed in the previous 24 hours.[11] Children aged five years and younger, and many children aged six to 11 years, completed the dietary recall through a proxy respondent. The dietary interviewers contacted schools and other care providers to obtain complete dietary intake information. Individual foods were coded and classified using the U.S. Department of Agriculture's Survey Nutrient Database System. Using the dietary intake information, we construct measures of soft drink consumption, including whether the youth consumed a soft drink during the recall period, the total grams consumed, and the total calories consumed from soft drinks. To explore the possibility of substitution effects, we also construct similar measures for juice, juice-like drinks, and whole milk.[12]

We merge NHANES III data with the NHANES 1999-2006 data. All relevant survey questions are asked similarly across the survey years, with the exception of race and ethnicity. We measure race and ethnicity as black non-Hispanic, white non-Hispanic, and other race or ethnicity to construct categories which are consistent throughout the survey. We restrict the sample to children and adolescents between the ages of 3 and 18 with non-missing height and weight or soft drink consumption information.

Table 2 displays the summary statistics. Fifteen percent of children are obese and 30 percent are overweight or obese. Fifty nine percent of children consume any soft drink during the day with an average of 332 grams or 12 ounces and 122 calories per day. Although the average caloric intake from soda represents only 6 percent of the average total caloric intake, soft

[11] To be consistent with NHANES III and NHANES 1999-2004, we use recall data from only the first day of the dietary interview for the 2005-2006 survey wave.

[12] These categories are defined in the appendix. Although we are unable to distinguish between diet and regular soft drinks between 1999 and 2006, we have information on grams of consumption as well as calories, which allows us some ability to distinguish diet and regular soda consumption since diet soda does not have calories.

drinks represent a significant component of children's diets compared to other beverages. Children are approximately twice as likely to drink any soft drink during the day as juice, juice-related drinks, or whole milk and the calories consumed from soft drinks are also approximately twice the amount of calories consumed from these other drinks.

Results

Table 3 presents the baseline associations between soft drink tax rates and soft drink consumption. The soft drink tax coefficients represent the effects of a one percentage point increase in the tax rate on the probability of consuming a soft drink, the total grams of soft drinks consumed, and the total calories from soft drinks consumed. All regression models throughout the paper include year, quarter, and state fixed effects (unreported), and standard errors are clustered at the state level. Regressions are estimated using ordinary least squares and NHANES survey weights are used throughout the paper.[13] [14]

As shown in Table 3, we find little influence of a tax on soft drinks on the probability that a youth consumes soda. However, a tax on soft drinks does influence the amount of soda that youths consume. A one percentage point increase in the soft drink tax rate reduces the amount of calories consumed by soda by nearly 8 calories, which is about 6 percent of the sample mean. This reduction in calories is likely not caused by a switch to diet soft drinks as there is a 22 gram

[13] The outcomes variables that measure the grams and calories consumed of different beverages are naturally censored at 0. An alternative to linear regression in the presence of censored dependent variables is the Tobit model. Our results are qualitatively similar to estimates based on Tobit models. However, estimates from Tobit models are not consistent in the presence of heteroskedastic errors or fixed effects. Following Angrist (2001), we report the linear regression estimates as our preferred estimates.

[14] For regressions with one of the consumption outcomes as the dependent variable, we use the survey weights for the dietary recall data. For regressions with one of the weight outcomes as the dependent variable, we use the survey weights for the mobile examination center data. To construct survey weights for our combined NHANES dataset, we follow the NCHS recommended analytic guidelines and divide the NCHS-supplied weights for each cycle by the number of cycles in our dataset. These weights incorporate the probability of being surveyed and adjustments for non-response.

decrease in soft drink consumption from a one percentage point increase in the soft drink tax rate, which is also about 6 percent of the sample mean.

Thus, our initial findings suggest that increasing the taxes on soft drinks will lead to reductions in soft drink consumption by children and adolescents. The magnitude of the reduction is somewhat modest. As discussed before, there is evidence that reducing consumption by 100 calories per day could prevent weight gain in 90 percent of the population (Ludwig et al. 2001), but typical increases in the soda tax of 1 to 2 percentage points would not dramatically affect caloric intake. The point estimates suggest, though, that an increase in the tax rate of over 12 percentage points would be required to affect a reduction in soda of approximately 100 calories per day; however, an increase of this magnitude is outside the support of our data. Indeed, several recent proposals have called for this magnitude of tax rate increase—for example Governor Patterson of New York recently suggested an 18% "obesity tax" on soft drinks. However, while soda consumption may be reduced with a large tax increase, it is important to understand whether this represents a reduction in total calories or whether individuals may respond to the tax by increasing consumption of non-taxed items of similar calories.

We next examine potential substitution patterns between soft drinks and other high-calorie consumption items that are not typically included in soft drink tax definitions, such as juice, juice-related drinks, and whole milk. As shown in Table 4, there is some suggestive evidence that soft drink taxes affect the consumption of juice or juice-related drink. The results do show that whole milk is a substitute for soft drinks; a one percentage point increase in the soft drink tax rate increases caloric intake from whole milk by 8 calories per day, which is 14 percent of the sample mean. Similarly, a one percentage point increase in the soft drink tax rate

increases whole milk consumption by 12 grams or 13 percent of the sample mean. The decrease in calories from soft drinks in response to an increase in the soft drink tax rate is completely offset by the increase in calories from whole milk. Thus, in Table 5, the results show that there is no statistically significant impact of the soft drink tax rate on total calories.

Given the results that a change in the soft drink tax rate induces youths to substitute whole milk for soft drinks and that the magnitude of these effects is similar, it is not likely that an increase in soft drink taxes would decrease obesity. Indeed as shown in Table 6, the results confirm that soft drink taxes have little influence on BMI, overweight, or obesity among children and adolescents. Similar to Fletcher, Frisvold, and Tefft's (2009) estimates for adults, the estimates are small in magnitude and not statistically significant.[15]

Overall, our estimates, which are identified using variation within state over time, demonstrate that soft drink taxes reduce soft drink consumption. However children and adolescents are found to respond to the taxes by shifting consumption to other high-calorie beverages, such as whole milk. Therefore, the net effect of soda taxes on caloric intake is minimal, and we find no effect on weight outcomes in children and adolescents. Soda taxes seem to be an ineffective "obesity tax" due to a standard behavioral response to the policy, where children and adolescents consume more calories of relatively cheaper beverages, which is milk in this case.

Robustness Checks

In addition to our baseline results, we also perform several robustness checks in order to increase confidence that we are estimating the causal effects of soft drink taxes on outcomes.

[15] As shown in Appendix Table 1, restricting the sample to states that have ever had a soft drink tax has little influence on the results shown in Tables 3 through 6.

One concern about the validity of these estimates is whether changes in state soft drink taxes are endogenous. To address this possibility, we include time-varying state characteristics as additional covariates. As shown in Table 7, the main results are robust to the inclusion of the one-year lagged state mean of adult BMI, one-year lagged unemployment rates, and cigarette tax rates. These additional results demonstrate that the main findings in this paper are unaffected by the possibility that states raise soft drink taxes in response to changes in population weight or changes in the macro economy.

Given that children spend a large portion of their time in school, an additional concern is that the changes in soft drink tax rates coincide with changes in school food policies. For example, Clark and Gleason (2006) find that participation in the National School Lunch Program is associated with a decrease in soft drink consumption and an increase in whole milk consumption. To address this possibility, we examine the impact of soft drink taxes on beverage consumption on weekdays and on weekends. As shown in Table 8, we find evidence of a decrease in calories consumed from soft drinks and an increase in calories consumed from whole milk on both the weekend and on weekdays.

Conclusion

In this paper, we present the first evidence of whether soft drink taxes are linked with consumption decisions and weight outcomes of children and adolescents. We use a national sample that contains weight outcomes and consumption patterns of children and adolescents between 1988 and 2006. We then merge newly collected state-level soft drink tax data for this time period with the survey data in order to use a quasi-natural experimental design to estimate the short term effects of soft drink taxation. Our results suggest that soft drink taxation, as

currently practiced in the United States, leads to a moderate decrease in the quantity of soft drinks consumed by children and adolescents. As a result, soft drink taxation may yield lower revenues for states than expected if behavioral responses to the tax are not accounted for. Additionally, soft drink taxes do not appear to have countered the rise in obesity prevalence because any reduction in soft drink consumption has been offset by the consumption of other calories. Cast in this light, the revenue generation and health benefits of soft drink taxes appear to be weaker than expected.

Despite this evidence against the effectiveness of soft drink taxes to reduce obesity, we believe that there are at least two directions for further inquiry in this area. First, although there is no evidence that soft drink taxes improve weight outcomes in children and adolescents, the fact that children and adolescents substitute more nutritious whole milk for soft drinks when taxed suggests that there may be broader health benefits that are not yet understood. Second, most historical tax rates are considerably lower than those that have been recently proposed, so that extrapolating our results to much larger increases in tax rates may not be appropriate. It is possible that there is a tax rate threshold at which consumers' reactions are greatly magnified, so it is unclear whether consumer substitution patterns would be sufficiently different with large tax changes to reduce total caloric intake. Findings from these areas of inquiry could suggest that there are pathways by which it is possible that soft drink taxes could indirectly improve child and adolescent health. However, the evidence to date is that soft drink taxes are ineffective as an "obesity tax".

References

Adams, Scott and Chad Cotti. (2008). Drunk driving after the passage of smoking bans in bars Journal of Public Economics Volume 92, Issues 5-6, Pages 1288-1305

Adda, Jerome and Francesca Cornaglia. (2006). Taxes, Cigarette Consumption, and Smoking Intensity. American Economic Review, 96(4) 1013-1028.

Adda, Jerome and Francesca Cornaglia. (in press). The Effect of Bans and Taxes on Passive Smoking. American Economic Journal: Applied Economics.

Andreyeva, Tatiana, Michael Long, and Kelly Brownell. (in press). The Impact of Food Prices on Consumption: A Systematic Review of Research on Price Elasticity of Demand for Food. American Journal of Public Health.

Angrist, Joshua D. (2001) "Estimation of Limited Dependent Variable Models with Dummy Endogenous Regressors: Simple Strategies for Empirical Practice," Journal of Business & Economic Statistics, 19(1), 2-16.

Baum, C., 2009. The effects of cigarette costs on BMI and obesity, Health Economics 18 (1), 3–19.

Bhattacharya, Jay, Kate Bundorf, Noemi Pace, and Neeraj Sood (2009). Does Health Insurance Make You Fat? NBER Working Paper 15163.

Block, G. (2004). "Foods Contributing to Energy Intake in the US: Data from NHANES III and NHANES 1999-2000." *Journal of Food Composition and Analysis*, 17: 439-447

Brownell, KD, and Frieden, TR, (2009). "Ounces of Prevention – The Public Policy Case for Taxes on Sugared Beverages." *N Engl J Med* 360;18.

Cawley, J. S. Markowitz and J. Tauras, Lighting up and slimming down: the effects of body weight and cigarette prices on adolescent smoking initiation, *Journal of Health Economics* **23** (2004), pp. 293–311

Cawley, John, Chad Meyerhoefer, and David Newhouse. (2007). The Impact of State Physical Education Requirements on Youth Physical Activity and Overweight. Health Economics, 16(12), 1287-1301.

Chaloupka, F and K. Warner, (2000). The economics of smoking. In: A. Cuyler and J. Newhouse, Editors, *Handbook of Health Economics*, North-Holland, Elsevier Science, Netherlands.

Chou, S.-Y., M. Grossman and H. Saffer, "An economic analysis of adult obesity: results from the behavioral risk factor surveillance system," *Journal of Health Economics* **23** (2004), pp. 565–587.

S. Chou, M. Grossman and H. Saffer, Reply to Jonathan Gruber and Michael Frakes, *Journal of Health Economics* **25** (2006), pp. 389–393.

Chriqui, J. F., S. S. Eidson, H. Bates, S. Kowalczyk and F. J. Chaloupka (2008). "State Sales Tax Rates for Soft Drinks and Snacks Sold through Grocery Stores and Vending Machines, 2007." *J Public Health Pol* 29(2): 226-249.

Clark, Melissa and Phil Gleason (2006) "School Meal Participation, Beverage Consumption, and Child Obesity: Evidence from the CSFII," working paper.

The Council of State Governments, 1990-2007. *The Book of the States*, Lexington, KY: Council of State Governments.

Courtemanche, Charles. (in press). "Rising Cigarette Prices and Rising Obesity: Coincidence or Unintended Consequence?", Journal of Health Economics.

Dharmasena, S., Capps, O. (2009). "Demand Interrelationships of At-Home Nonalcoholic Beverage Consumption in the United States." Presented at the Agricultural & Applied Economics Association's 2009 AAEA & ACCI Joint Annual Meeting, Milwaukee, Wisconsin, July 26-29, 2009.

Evans, William N. and Matthew C. Farrelly. (1998). The Compensating Behavior of Smokers: Taxes, Tar, and Nicotine. RAND Journal of Economics, 29(3), 578-595.

Finkelstein, E.A., Trogdon, J.G., Cohen, J.W., Dietz, W. "Annual Medical Spending Attributable to Obesity: Payer- And Service-Specific Estimates." *Health Affairs*, doi: 10.1377/hlthaff.28.5.w822

Fletcher, JM. (2009) "The Effect of Smoking Cessation on Weight Gain: Evidence Using Workplace Smoking Restrictions." Working Paper

Fletcher, JM., Frisvold, D, and Tefft, N, (2009). "Can Soft Drink Taxes Reduce Population Weight?," *Contemporary Economic Policy* (in press).

Gruber, J and Frakes, M, (2006). "Does falling smoking lead to rising obesity?" Journal of Health Economics, 25:2, 183-197.

Harnack L, Stang J &, Story M (1999): Soft drink consumption among US children and adolescents: nutritional consequences. *J. Am. Diet. Assoc.* **99**, 436–441.

Hill JO, Wyatt HR, Reed GW, Peters JC. (2003). "Obesity and the environment: where do we go from here?" *Science* 299: 853-7.

Jacobson, M and K. Brownell. (2000). "Small taxes on soft drinks and snack foods to promote health." *American Journal of Public Health*, 90(6): 854-857

Kenkel DS. (2005). Are alcohol tax hikes fully passed through to prices: evidence from Alaska. *American Economic Review* 95(2):273-277.

Ludwig, D.S., Peterson, K.E., & Gortmaker, S.L. (2001). Relation between consumption of sugar-sweetened drinks and childhood obesity: a prospective, observational analysis. *The Lancet*, Vol. 357 505-508.

Nader PR, O'Brien M, Houts R, Bradley RH, Belksy J, Crosnoe R, Friedman S, Mei Z, Susman EJ, Development National Institute of Child Health and Human Development Study of Early Child Care and Youth (2006) "Identifying risk for obesity in early childhood," *Pediatrics*, 118: e594-e601.

Office of the Surgeon General (2001) The Surgeon General's Call to Action to Prevent Overweight and Obesity, Rockville, MD: U.S. Department of Health and Human Services.

Peltzman, Sam. (1975). The Effects of Automobile Safety Regulation The Journal of Political Economy, Vol. 83, No. 4 pp. 677-726

Powell, LM, Chriqui, J, and Chaloupka, FJ, (2009). "Associations between State-level Soda Taxes and Adolescent Body Mass Index." *Journal of Adolescent Health* (in press).

Putnam JJ, Allshouse JE. (1999). "Food consumption, prices, and expenditures, 1970–97." Washington, DC: Food and Consumers Economics Division, Economic Research Service, US Department of Agriculture

Schroeter, C., J. Lusk and W. Tyner (2008). "Determining the Impact of Food Price and Income Changes on Body Weight." *Journal of Health Economics* 27(1): 45-68.

Sicher, John.(2007). "Special Issue: Top-10 CSD Results for 2006." Beverage Digest Volume 50 (5).

Sturm, R., 2002. The Effects of Obesity, Smoking, and Drinking on Medical Problems and Costs. *Health Affairs* 21, 245.

Tobacco-NAFTA Industry Guide. (2009). Datamonitor, February 2009, available at: http://www.researchandmarkets.com/reports/706797/tobacco_north_america_nafta_industry_guide.

Zheng, Y. and Kaiser, HM. (2008). "Advertising and U.S. Nonalcoholic Beverage Demand." *Agricultural and Resource Economics Review*, 37:2, pg 147-159.

Table 1. Summary Statistics: Soft Drink Tax Rates, 1988-2006

	All States		States with a Positive Tax Rate		
Year	Mean Tax Rate	Standard Deviation	Count	Mean Tax Rate	Standard Deviation
1988	1.552	2.311	19	4.166	1.829
1989	1.623	2.335	20	4.139	1.841
1990	1.839	2.526	21	4.465	1.906
1991	1.971	2.591	22	4.569	1.882
1992	2.067	2.587	23	4.583	1.776
1993	2.334	2.919	24	4.960	2.220
1994	2.334	2.919	24	4.960	2.220
1995	2.084	2.618	23	4.621	1.822
1996	2.076	2.608	23	4.604	1.815
1997	2.076	2.608	23	4.604	1.815
1998	1.954	2.603	21	4.745	1.742
1999	1.934	2.584	21	4.698	1.748
2000	1.875	2.544	20	4.783	1.549
2001	1.758	2.488	19	4.718	1.564
2002	1.728	2.550	18	4.897	1.642
2003	1.755	2.589	18	4.974	1.663
2004	1.895	2.676	19	5.087	1.661
2005	1.888	2.667	19	5.067	1.658
2006	1.890	2.674	19	5.074	1.677

Note: Column variables represent means or percents across all states for the given year.

Table 2: Descriptive Statistics

Variable	Mean	Standard Error
BMI Z-score	0.420	0.011
Obese	0.149	0.004
Overweight	0.298	0.005
Underweight	0.033	0.002
Total Calories	2062.073	9.650
Total Calories from Soft Drinks	122.349	2.000
Consumed any Soft Drink	0.587	0.005
Total Grams of Soft Drink Consumption	331.803	5.099
Total Calories from Juice	50.631	1.072
Consumed any Juice	0.329	0.005
Total Grams of Juice Consumption	109.150	2.244
Total Calories from Juice Drinks	66.060	1.266
Consumed any Juice Drinks	0.368	0.005
Total Grams of Juice Drinks Consumption	165.472	3.272
Total Calories from Whole Milk	58.235	1.334
Consumed any Whole Milk	0.253	0.004
Total Grams of Whole Milk Consumption	93.469	2.147
Dietary Recall is Based on a Weekday	0.626	0.005
Female	0.490	0.005
Age	10.510	0.043
Black	0.149	0.002
Other Race/Ethnicity (including Hispanic)	0.240	0.004
White	0.610	0.005
Soft Drink Tax Rate	2.718	0.029
N(weight variables)	22045	
N(drink variables)	20953	
N(demographics)	22342	

Notes: Descriptive statistics are weighted using the NHANES survey weights.
Sources: NHANES 1998-1994 and 1999-2006.

Table 3: The Impact of Soft Drink Taxes on Soft Drink Consumption and Calories Consumed from Soft Drinks

	Consumed a Soft Drink	Total Grams of Soft Drink Consumption	Calories from Soft Drinks
Soft Drink Tax Rate	-0.007	-22.227**	-7.896**
	(0.006)	(9.566)	(3.836)
Observations	20953	20953	20953
R-squared	0.088	0.169	0.161

Notes: Heteroskedasticity-robust standards errors in parentheses that allow for clustering within states. Additional variables include female, age, age squared, black, other race, weekday, state, year, and quarter. All regressions utilize NHANES survey weights.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4: The Impact of Soft Drink Taxes on Non-Soft Drink Beverage Consumption and Calories Consumed from Non-Soft Drink Beverages

	Juice Consumption	Juice Drink	Whole Milk
Panel A: Caloric Intake			
Soft Drink Tax Rate	-0.119	1.833	8.227***
	(2.035)	(2.470)	(1.969)
Observations	20953	20953	20953
R-squared	0.032	0.032	0.066
Panel B: Grams of Consumption			
Soft Drink Tax Rate	1.272	5.982	12.010***
	(4.212)	(6.570)	(3.185)
Observations	20953	20953	20953
R-squared	0.031	0.034	0.064

Notes: Heteroskedasticity-robust standards errors in parentheses that allow for clustering within states. Additional variables include female, age, age squared, black, other race, weekday, state, year, and quarter. All regressions utilize NHANES survey weights.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5: The Impact of Soft Drink Taxes on Total Caloric Intake

	Total Caloric Intake
Soft Drink Tax Rate	-10.980
	(15.038)
Observations	20953
R-squared	0.145

Notes: Heteroskedasticity-robust standards errors in parentheses that allow for clustering within states. Additional variables include female, age, age squared, black, other race, weekday, state, year, and quarter. All regressions utilize NHANES survey weights.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 6: The Impact of Soft Drink Taxes on BMI, Obese, and Overweight

	BMI Z-score	Obese	Over-weight	Under-weight
Soft Drink Tax Rate	0.014	0.008	0.003	-0.001
	(0.017)	(0.006)	(0.011)	(0.003)
Observations	22045	22045	22045	22045
R-squared	0.027	0.023	0.027	0.008

Notes: Heteroskedasticity-robust standards errors in parentheses that allow for clustering within states. Additional variables include female, age, age squared, black, other race, state, year, and quarter. All regressions utilize NHANES survey weights.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 7: Alternative Specifications that Control for Additional State Characteristics

	BMI Z-score	Obese	Over-weight	Soft Drink Calories	Juice Calories	Juice Drink Calories	Whole Milk Calories	Total Calories
Controlling for Lagged State Average BMI	0.018	0.008	0.005	-6.956*	0.449	2.402	8.197***	-9.925
	(0.016)	(0.007)	(0.011)	(3.471)	(1.805)	(2.250)	(2.125)	(14.848)
N	21785	21785	21785	20717	20717	20717	20717	20717
Controlling for Lagged State Unemployment Rate	0.015	0.008	0.003	-8.162**	-0.131	1.646	8.208***	-11.304
	(0.018)	(0.006)	(0.011)	(3.480)	(2.059)	(2.266)	(2.010)	(14.945)
N	22045	22045	22045	20953	20953	20953	20953	20953
Controlling for Cigarette Taxes	0.016	0.009	0.005	-6.155	0.034	1.317	7.836***	-12.488
	(0.018)	(0.006)	(0.011)	(3.805)	(2.014)	(2.385)	(2.112)	(15.106)
N	22045	22045	22045	20953	20953	20953	20953	20953
Controlling for All of the Above	0.023	0.009	0.007	-6.165*	0.487	1.313	7.874***	-12.677
	(0.019)	(0.007)	(0.011)	(3.464)	(1.846)	(2.073)	(2.401)	(15.145)
N	21785	21785	21785	20717	20717	20717	20717	20717

Notes: Heteroskedasticity-robust standards errors in parentheses that allow for clustering within states. Each cell represents a separate regression. Additional variables include female, age, age squared, black, other race, state, year, and quarter. All regressions utilize NHANES survey weights.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 8: The Impact of Soft Drink Taxes on Consumption during on Weekdays and the Weekend

	Calories from Soft Drinks	Total Grams of Soft Drink Consumption	Juice Calories	Juice Drink Calories	Whole Milk Calories	Total Calories
Panel A: Weekday						
Soft Drink Tax Rate	-8.917**	-25.915**	-2.033	2.129	8.398***	-29.444*
	(4.357)	(11.572)	(1.999)	(3.270)	(2.230)	(17.373)
Observations	14227	14227	14227	14227	14227	14227
R-squared	0.153	0.163	0.048	0.035	0.071	0.150
Panel B: Weekend						
Soft Drink Tax Rate	-7.309	-20.504	4.046	1.086	5.471**	19.617
	(6.549)	(15.637)	(4.076)	(2.758)	(2.402)	(23.360)
Observations	6726	6726	6726	6726	6726	6726
R-squared	0.182	0.188	0.031	0.054	0.079	0.154

Notes: Heteroskedasticity-robust standards errors in parentheses that allow for clustering within states. Additional variables include female, age, age squared, black, other race, state, year, and quarter. All regressions utilize NHANES survey weights.
* significant at 10%; ** significant at 5%; *** significant at 1%

Appendix Table 1: NHANES, The Impact of Soft Drink Taxes on BMI, Obese, and Overweight for the Sample of States with a Soft Drink Tax

Panel A: Consumption	Soft Drink Calories	Juice Calories	Juice Drink Calories	Whole Milk Calories
Soft Drink Tax Rate	-9.485**	0.149	2.361	6.141***
	(4.492)	(2.292)	(2.368)	(1.705)
Observations	14103	14103	14103	14103
R-squared	0.159	0.029	0.032	0.068

Panel B: Weight Outcomes	BMI Z-score	Obese	Over-weight	Under-weight
Soft Drink Tax Rate	0.016	0.011*	0.006	-0.001
	(0.016)	(0.005)	(0.010)	(0.003)
Observations	14827	14827	14827	14827
R-squared	0.025	0.023	0.029	0.009

Notes: Heteroskedasticity-robust standards errors in parentheses that allow for clustering within states. The results in this table are based on specification similar to those from Table 5, except that the sample is restricted to individuals living in states with a positive soft drink tax rate. Additional variables include female, age, age squared, black, other race, state, year, and quarter. All regressions utilize NHANES survey weights.
* significant at 10%; ** significant at 5%; *** significant at 1%

Appendix: Definitions of Soda, Juice, and Juice Drinks

Definition of Soft Drinks

USDA Food Code	Label
92400000	SOFT DRINK, NFS
92400100	SOFT DRINK, NFS, SUGAR-FREE
92410110	CARBONATED WATER,SWEETEND(INCL TONIC,QUININE WATER)
92410210	CARBONATED WATER, UNSWEETENED (INCL CLUB SODA)
92410250	CARBONATED WATER, SUGAR-FREE
92410310	SOFT DRINK, COLA-TYPE
92410315	SOFT DRINK, COLA TYPE, REDUCED SUGAR
92410320	SOFT DRINK, COLA-TYPE, SUGAR-FREE
92410330	SOFT DRINK, COLA-TYPE, W/ HIGHER CAFFEINE (INCL JOLT)
92410340	SOFT DRINK, COLA-TYPE, DECAFFEINATED
92410350	SOFT DRINK, COLA-TYPE, DECAFFEINATED, SUGAR-FREE
92410360	SOFT DRINK, PEPPER-TYPE (INCL DR. PEPPER, MR. PIBB)
92410370	SOFT DRINK, PEPPER-TYPE, SUGAR-FREE
92410390	SOFT DRINK, PEPPER-TYPE, DECAFFEINATED
92410400	SOFT DRINK, PEPPER-TYPE, DECAFFEINATED, SUGAR-FREE
92410410	CREAM SODA
92410420	CREAM SODA, SUGAR-FREE
92410510	SOFT DRINK, FRUIT-FLAVORED, CAFFEINE FREE
92410520	SOFT DRINK, FRUIT-FLAV, SUGAR-FREE, CAFFEINE FREE
92410550	SOFT DRINK, FRUIT-FLAVORED, W/ CAFFEINE
92410560	SOFT DRINK, FRUIT-FLAVORED, W/ CAFFEINE, SUGAR-FREE
92410610	GINGER ALE
92410620	GINGERALE, SUGAR-FREE
92410710	ROOT BEER
92410720	ROOT BEER, SUGAR-FREE
92410810	CHOCOLATE-FLAVORED SODA
92410820	CHOCOLATE-FLAVORED SODA, SUGAR-FREE
92411510	COLA W/ FRUIT OR VANILLA FLAVOR
92411520	COLA W/ CHOCOLATE FLAVOR
92411610	COLA W/ FRUIT OR VANILLA FLAVOR, SUGAR-FREE
92411620	COLA W/ CHOC FLAVOR, SUGAR FREE
92416010	MAVI DRINK
92417010	SOFT DRINK, ALE TYPE (INCLUDE ALE-8)
92431000	CARBONATED JUICE DRINK, NS AS TO TYPE OF JUICE
92432000	CARBONATED CITRUS JUICE DRINK
92433000	CARBONATED NONCITRUS JUICE DRINK

Definition of Juice

USDA Food Code	LABEL
61201000	GRAPEFRUIT JUICE, NFS
61201010	GRAPEFRUIT JUICE, FRESHLY SQUEEZED
61201020	GRAPEFRUIT JUICE, UNSWEETENED, NS AS TO FORM
61201220	GRAPEFRUIT JUICE, CANNED, BOTTLED, CARTON, UNSWEET
61201230	GRAPEFRUIT JUICE, CANNED, BOTTLED, CARTON, W/ SUGAR
61201620	GRAPEFRUIT JUICE, FROZEN, UNSWEETENED (RECONST)
61201630	GRAPEFRUIT JUICE, FROZEN, W/ SUGAR (RECONSTITUTED)
61204000	LEMON JUICE, NS AS TO FORM
61204010	LEMON JUICE, FRESH
61204200	LEMON JUICE, CANNED OR BOTTLED
61204600	LEMON JUICE, FROZEN
61207000	LIME JUICE, NS AS TO FORM
61207010	LIME JUICE, FRESH
61207200	LIME JUICE, CANNED OR BOTTLED
61207600	LIME JUICE, FROZEN
61210000	ORANGE JUICE, NFS
61210010	ORANGE JUICE, FRESHLY SQUEEZED
61210220	ORANGE JUICE, CANNED/BOTTLED/CARTON, UNSWEETENED
61210230	ORANGE JUICE, CANNED/BOTTLED/CARTON, W/ SUGAR
61210250	ORANGE JUICE, W/ CALCIUM, CAN/BOTTLE/CARTON, UNSWEETENED
61210620	ORANGE JUICE, FROZEN, UNSWEETENED, RECONST W/ WATER
61210630	ORANGE JUICE, FROZEN, W/ SUGAR, RECONST W/ WATER
61210720	ORANGE JUICE, FROZEN, UNSWEETENED, NOT RECONSTITUTD
61210730	ORANGE JUICE, FROZEN, W/ SUGAR, NOT RECONSTITUTED
61210820	ORANGE JUICE,FROZ, W/,CALCIUM ADDED,RECON W/WATER
61213000	TANGERINE JUICE, NFS
61213220	TANGERINE JUICE, CANNED, UNSWEETENED
61213230	TANGERINE JUICE, CANNED, W/ SUGAR
61213620	TANGERINE JUICE, FROZEN, UNSWEET, RECONST W/ WATER
61213800	FRUIT JUICE BLEND, INCL CITRUS, 100% JUICE
61214000	GRAPE-TANGERINE-LEMON JUICE
61216000	GRAPEFRUIT & ORANGE JUICE, NFS
61216010	GRAPEFRUIT & ORANGE JUICE, FRESH
61216220	GRAPEFRUIT & ORANGE JUICE, CANNED, UNSWEETENED
61216230	GRAPEFRUIT & ORANGE JUICE, CANNED, W/ SUGAR
61216620	GRAPEFRUIT & ORANGE JUICE, FROZEN, (RECONSTITUTED)
61219000	ORANGE & BANANA JUICE
61219100	PINEAPPLE-ORANGE-BANANA JUIICE
61219150	ORANGE-WHITE GRAPE-PEACH JUICE
61219650	APRICOT-ORANGE JUICE

61222000	PINEAPPLE-GRAPEFRUIT JUICE, NFS
61222200	PINEAPPLE-GRAPEFRUIT JUICE, CANNED, NS SWEETENED
61222220	PINEAPPLE-GRAPEFRUIT JUICE, CANNED, UNSWEETENED
61222230	PINEAPPLE-GRAPEFRUIT JUICE, CANNED, W/ SUGAR
61222600	PINEAPPLE-GRAPEFRUIT JUICE, FROZEN, RECONST W/WATER
61225000	PINEAPPLE-ORANGE JUICE, NFS
61225200	PINEAPPLE-ORANGE JUICE, CANNED, NS AS TO SWEETENER
61225220	PINEAPPLE-ORANGE JUICE, CANNED, UNSWEETENED
61225230	PINEAPPLE-ORANGE JUICE, CANNED, W/ SUGAR
61225600	PINEAPPLE-ORANGE JUICE, FROZEN, RECONST W/ WATER
61226000	STRAWBERRY-BANANA-ORANGE JUICE
64100100	FRUIT JUICE, NFS (INCLUDE MIXED FRUIT JUICES)
64100110	FRUIT JUICE BLEND, 100% JUICE, W/ VITAMIN C
64100120	AMBROSIA JUICE (INCL KNUDSEN'S)
64100200	FRUIT JUICE BLEND, WITH CRANBERRY, 100% JUICE
64101010	APPLE CIDER (INCLUDE CIDER, NFS)
64104010	APPLE JUICE
64104050	APPLE JUICE, W/ ADDED VITAMIN C
64104090	APPLE JUICE WITH ADDED VITAMIN C AND CALCIUM
64104150	APPLE-CHERRY JUICE
64104200	APPLE-PEAR JUICE
64104450	APPLE-RASPBERRY JUICE
64104500	APPLE-GRAPE JUICE
64104550	APPLE-GRAPE-RASPBERRY JUICE
64104600	BLACKBERRY JUICE (INCL BOYSENBERRY JUICE)
64105400	CRANBERRY JUICE, UNSWEETENED
64105500	CRANBERRY-WHITE GRAPE JUICE MIXTURE, UNSWEETENED
64116010	GRAPE JUICE, NS AS TO ADDED SWEETENER
64116020	GRAPE JUICE, UNSWEETENED
64116030	GRAPE JUICE, W/ SUGAR
64116040	GRAPE JUICE, LOW CALORIE SWEETENER
64116050	GRAPE JUICE, NS AS TO SWEETENED, W/ ADDED VITAMIN C
64116100	GRAPE JUICE, UNSWEETENED, W/ ADDED VITAMIN C
64116150	GRAPE JUICE, W/ SUGAR, W/ ADDED VITAMIN C
64120010	PAPAYA JUICE
64121000	PASSION FRUIT JUICE
64122030	PEACH JUICE, W/ SUGAR
64123000	PEAR-WHITE-GRAPE-PASSION FRUIT JUICE,W/ADDED VIT C
64124010	PINEAPPLE JUICE, NS AS TO SWEETENED
64124020	PINEAPPLE JUICE, UNSWEETENED
64124030	PINEAPPLE JUICE, W/ SUGAR
64124060	PINEAPPLE JUICE, UNSWEETENED, W/ VIT C
64124200	PINEAPPLE-APPLE-GUAVA JUICE, W/ ADDED VITAMIN C

64125000	PINEAPPLE JUICE-NON-CITRUS JUICE BLEND, UNSWEETENED
64132010	PRUNE JUICE, NS AS TO ADDED SWEETENER
64132020	PRUNE JUICE, UNSWEETENED
64132030	PRUNE JUICE, W/ SUGAR
64132500	STRAWBERRY JUICE
64133100	WATERMELON JUICE
74301100	TOMATO JUICE
74301150	TOMATO JUICE, LOW SODIUM
74302000	TOMATO JUICE COCKTAIL
74303000	TOMATO & VEGETABLE JUICE, MOSTLY TOMATO (INCL V-8)
74303100	TOMATO & VEGETAGLE JUICE, MOSTLY TOMATO, LOW SODIUM
74304000	TOMATO JUICE W/ CLAM OR BEEF JUICE

Definition of Juice Drink

USDA Food Code	LABEL
92510120	APPLE-CHERRY DRINK
92510150	APPLE JUICE DRINK
92510170	APPLE-CRANBERRY-GRAPE JUICE DRINK
92510200	APPLE-ORANGE-PINEAPPLE JUICE DRINK
92510310	BANANA-ORANGE DRINK
92510410	BLACK CHERRY DRINK
92510610	FRUIT DRINK (INCLUDE FRUIT PUNCH & FRUIT ADE)
92510630	FRUIT JUICE DRINK, NFS
92510650	TAMARIND DRINK, P.R. (REFRESCO DE TAMARINDO)
92510720	FRUIT PUNCH, MADE W/ FRUIT JUICE & SODA
92510730	FRUIT PUNCH, MADE W/ SODA, FRUIT JUICE & SHERBET
92510810	GRAPEADE & GRAPE DRINK
92510820	GRAPE JUICE DRINK
92510910	GRAPEFRUIT JUICE DRINK
92510950	GUAVA JUICE DRINK
92511000	LEMONADE, FROZEN CONCENTRATE, NOT RECONSTITUTED
92511010	LEMONADE
92511020	LEMON-LIMEADE
92511110	LIMEADE
92511190	ORANGE JUICE DRINK
92511200	ORANGE-MANGO JUICE DRINK
92511220	ORANGE DRINK (INCLUDE ORANGE ADE, YABA DABA DEW)
92511240	ORANGE-LEMON DRINK
92511250	CITRUS FRUIT JUICE DRINK (INCL 5-ALIVE)
92511260	ORANGE-CRANBERRY JUICE DRINK
92511270	ORANGE-PEACH JUICE DRINK
92511280	ORANGE-GRAPE-BANANA JUICE DRINK
92511290	PAPAYA JUICE DRINK
92511340	PINEAPPLE-ORANGE JUICE DRINK
92511350	ORANGE-RASPBERRY JUICE DRINK
92511400	RASPBERRY-FLAVORED DRINK
92511510	STRAWBERRY-FLAVORED DRINK
92512040	FROZEN DAIQUIRI MIX, CONCENTRATE, NOT RECONSTITUTED
92512050	FROZEN DAIQUIRI MIX, FROM FROZ CONC, RECONSTITUTED
92512090	PINA COLADA, NONALCOHOLIC
92512110	WHISKEY SOUR, NONALCOHOLIC (INCL LEMIX)
92520410	FRUIT DRINK, LOW CALORIE
92520810	GRAPE DRINK, LOW CALORIE
92520910	LEMONADE, LOW CALORIE
92530310	CHERRY DRINK W/ VITAMIN C ADDED

92530410	CITRUS DRINK W/ VITAMIN C ADDED
92530510	CRANBERRY JUICE DRINK W/VIT C ADDED(INCL COCKTAIL)
92530520	CRANBERRY-APPLE JUICE DRINK W/ VITAMIN C ADDED
92530610	FRUIT PUNCH/DRINK/ADE W/ VIT C ADDED (INCL HI-C)
92530710	GRAPE DRINK W/ VITAMIN C ADDED
92530810	GRAPEFRUIT JUICE DRINK W/ VITAMIN C ADDED
92530840	GUAVA JUICE DRINK W/ VIT C ADDED
92530910	LEMONADE W/ VITAMIN C ADDED
92530950	VEGETABLE & FRUIT JUICE DRINK, W/ VIT C
92531010	ORANGE DRINK & ORANGEADE W/ VITAMIN C ADDED
92531020	ORANGE BREAKFAST DRINK, FROM FROZEN CONCENTRATE
92531030	ORANGE BREAKFAST DRINK
92531120	PINEAPPLE-ORANGE JUICE DRINK W/ VITAMIN C ADDED
92531210	SRAWBERRY-FLAVORED DRINK W/ VITAMIN C ADDED
92541010	FRUIT-FLAVORED DRINK, FROM SWEETENED PWDR,FORTIFIED W/ VIT C
92541020	LEMONADE-FLAV DRINK, FROM POWDER, W/ SUGAR & VIT C
92541040	LEMONADE-FLAV DRINK, FROM POWDER, LO CAL, W/ VIT C
92541100	APPLE CIDER DRINK, FROM MIX, SUGAR & VIT C ADDED
92542000	FRUIT-FLAVORED DRINK, FROM POWDER, W/HI VIT C(TANG)
92544000	FRUIT-FLAVOR DRINK, FROM UNSWEET PWDR,W/ VIT C,W/ SUGAR
92550050	APPLE-WHITE GRAPE JUICE DRINK,LOW CAL,W/VIT C ADDED
92550110	CRANBERRY JUICE COCKTAIL, LO CAL, W/ VIT C ADDED
92550210	CRANBERRY-APPLE JUICE DRINK, LO CAL, VIT C ADDED
92550300	GRAPEFRUIT JUICE DRINK,LOW CALORIE,W/ VITAMIN C
92550110	CRANBERRY JUICE DRINK OR COCKTAIL, LOW CAL, W/ HIGH VIT C
92550610	FRUIT-FLAVORED DRINK, LOW CAL, W/ VITAMIN C ADDED
92550620	FRUIT FLAVORED DRINK, LOW CALORIE
92551600	CITRUS JUICE DRINK, LOW CALORIE
92551700	JUICE DRINK, LOW CALORIE
92552000	FRUIT-FLAV DRINK, FROM MIX, HI VIT C ADDED, LOW CAL
92552010	FRUIT FLAVORED DRINK, MADE FROM PWDR, LOW CALORIE
92552050	ORANGE BREAKFAST DRINK, LOW CALORIE
92552100	ORANGE-CRANBERRY JUICE DRINK,LOW CAL,W/ VIT C ADDED
92553000	FRUIT-FLAVORED THIRST QUENCHER BEVERAGE, LOW CAL
92560000	FRUIT-FLAVORED THIRST QUENCHER BEVERAGE
92560100	GATORADE THIRST QUENCHER SPORTS DRINK
92560200	POWERADE SPORTS DRINK
92570100	FLUID REPLACEMNT,ELECTROLYTE SOLUTN(INCL PEDIALYTE)
92570500	FLUID REPLACEMENT, 5% GLUCOSE IN WATER
92582100	CITRUS JUICE DRINK, CALCUIM FORTIFIED
92582110	ORANGE BREAKFAST DRINK, CALCIUM FORTIFIED