Journal of Public Economics 140 (2016) 30–50

Contents lists available at ScienceDirect

Journal of Public Economics

journal homepage: www.elsevier.com/locate/jpube

# Does banning carbonated beverages in schools decrease student consumption?☆

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ARTICLE INFO

*Article history:*
Received 5 March 2015
Received in revised form 27 May 2016
Accepted 31 May 2016
Available online 14 June 2016

*Keywords*:
Childhood obesity
School food environment
Purchase data
Soft drink consumption

ABSTRACT

I evaluate the effectiveness of carbonated beverage bans in schools by investigating their impact on household soda consumption. I match households in Nielsen Homescan data to their school district's carbonated beverage policies over an eight-year period (2002–2009). I find that when high schools ban the sale of carbonated beverages to students, households with a high school student experiencing the ban increase their consumption of non-diet soda by roughly the equivalent of 3.4 cans per month. I present evidence that this is a substantial offsetting (67–75%) of the average non-diet carbonated beverage consumption in high schools, when these are available to students, thus demonstrating the persistence of preferences when attempting to alter unhealthy habits.



## 1. Introduction

With growing concern regarding the obesity epidemic among children and adults, policy-makers have considered initiatives limiting access to unhealthy foods, under the assumption that this will reduce overall caloric intake among individuals.[1] However, given that it is infeasible to block all sources of unhealthy foods, it may be that individuals will respond to the limitation by finding an alternative source for what is being limited, thus decreasing effectiveness. This paper investigates this debate by evaluating bans on carbonated beverages in schools and their impact on students' household consumption.

I match households in Nielsen Homescan data to their school districts and these school districts' corresponding carbonated beverage availability policies. Overall, I collected carbonated beverage policies over an eight-year period (2002–2009) for 46 large school districts throughout the United States. The introduction of carbonated beverage bans in school districts generates three sources of variation: over time, across school districts, and across school-levels (elementary/middle/high). I therefore estimate whether compensation at the household level occurs in response to carbonated beverage bans using a difference-in-differences-in-differences (triple differences) model. The triple differences framework is advantageous to difference-in-differences (DID) models because it makes use of two, rather than one, control groups: households within school district boundaries which did not implement bans *and* households within school district boundaries which did implement bans who do not have school-aged children. Thus, in the triple differences framework, the only plausible threat to identification would be a factor that is correlated with carbonated beverage restrictions in the school district boundaries and is differentially affecting only households with children in the relevant school-level.

The results show that households with children in high school compensate for the lack of availability of non-diet carbonated beverages when high schools ban their sale. The compensation effect is found only for high school restrictions and not for elementary or middle school restrictions, and this is consistent with the fact that bans implemented at the school district level are typically binding at

☆ I am grateful to my advisors, Caroline Hoxby, Ran Abramitzky and Matthew Harding for their advice and comments. I thank David Frisvold, Roy Mill, John Pencavel, Oren Rigbi, Itay Saporta, Yannay Spitzer, Jenny Ying and Ro'i Zultan for useful comments and conversations. Thanks to seminar participants and/or attendees at the following: Stanford University, Ben-Gurion University, Hebrew University, Tel Aviv University, Interdisciplinary Center Herzeliya, Haifa University, the U.S. Department of Agriculture "Using Scanner Data to Answer Food Policy Questions" Conference, and at the 5th Bi-Annual American Society for Health Economists Conference. I am grateful to the U.S. Department of Agriculture, Economic Research Services for providing the Nielsen Homescan data. Tzur Vaza provided valuable research assistance for school districts' mapping using GIS software. The research leading to these results has received funding from the People Programme (Marie Curie Actions) of the European Union Seventh Framework Programme (FP7/2007-2013) under REA grant agreement no. 630714.

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[1] One of the most publicized and heavily-debated of these policy measures was Mayor Bloomberg's attempt in 2012 to restrict the serving size of soda and sugar-sweetened beverages sold in New York City, which was overruled in the court in 2013.

http://dx.doi.org/10.1016/j.jpubeco.2016.05.004
0047-2727/

the high school level, whereas at the elementary and middle school levels this is not so. For diet carbonated beverage restrictions, no significant change in household diet soda consumption is observed in response to bans. The results for diet versus non-diet carbonated beverages are supported by evidence that consumption of diet carbonated beverages in schools is very minimal, even when these beverages are readily available.

Quantitatively, the average household increases consumption of non-diet carbonated beverages, relative to the period prior to the high school carbonated beverage restriction, by roughly 41 fluid ounces per month for each treated high school household member, and this is averaged over more than a year following the ban introduction. This is equivalent to an average monthly increase of 3.4 cans in household non-diet soda consumption. Point-estimates for changes in household consumption after more than 15 months following the ban introduction have lower precision, and thus the magnitude of household changes in non-diet soda consumption for this later period cannot be estimated as confidently. I present evidence that the average consumption of non-diet carbonated beverages in high schools, when these are available, is roughly 4.5–5 cans per month. Thus, the estimated 3.4-can increase in non-diet soda consumption in response to bans in high schools suggests that compensation at home offsets approximately 67–75% of the average high school student's consumption levels of carbonated beverages when these are available in schools. The results further suggest that treated households exhibit the greatest positive compensation levels during the quarter immediately after the high school ban was introduced. The increase in soda consumption in response to the bans is reflective of *household* consumption and not the individual *student's* consumption. Thus, it may be that student compensation is less than the change observed. Nevertheless, when taking into account that the Nielsen Homescan data does not cover all potential channels through which compensation of carbonated beverages can take place (e.g., convenience stores, vending machines), I conclude that this is evidence of a substantial offsetting in response to high school carbonated beverage bans.

The results demonstrate that substitution patterns in consumption in response to narrowly-targeted policies can exist, thus limiting their effectiveness. I evaluate a policy which aims to promote a healthier habit beyond the premises in which the policy takes place. Thus, policy evaluations cannot be limited to the local level of policy implementation (i.e. in our case, the school) and a broader approach, which accounts for compensation or substitution of the unhealthy habit, has to be considered.[2] As such, this paper emphasizes the importance of individual preferences and their persistence, even when altering potential access to the desired consumption bundle. The results support previous findings regarding compensatory behavior concerning unhealthy eating habits (Fletcher et al., 2010a; Wisdom et al., 2010) or cigarette smoking (Adda and Cornaglia, 2006, 2010), as well as substitution of one healthy habit with another (Cawley et al., 2013). Fletcher et al. (2010a) also look into household responses to policy measures aimed at curbing obesity, namely taxes on soda at the state level. Using data on child and adolescent body mass index (BMI) and food and beverage consumption recall from the National Health and Nutrition Examination Survey (NHANES), the authors find that taxes on soft drinks lead to a decrease in child and adolescent soft drink consumption. However, this reduction in soda consumption is completely offset by increases in consumption of other high-calorie drinks. Both the results of this paper and the results presented in Fletcher et al. (2010a) complement each other by highlighting the persistence of eating habits within the household, even following various policy interventions intended to change these — while in Fletcher et al. (2010a) households find substitute products, in this paper households find alternative sources for obtaining their carbonated beverages. In contrast to the existing literature, the substitution patterns found in this study are across different times of the day, as opposed to different products (e.g., Fletcher et al., 2010a) or their usage (e.g., Adda and Cornaglia, 2006, 2010).

The paper contributes to the existing literature on school food environments, which mostly examines how specific school food environments affect children's obesity or BMI outcomes (Anderson and Butcher, 2006; Currie et al., 2010; Datar and Nicosia, 2012) or evaluates health effects of school meals programs (Bhattacharya et al., 2006; Gleason et al., 2009; Millimet et al., 2010; Schanzenbach, 2009). However, very few papers in the literature address the underlying consumption mechanisms among children when school food environments change — i.e how households or individuals respond to changes in policies related to the school food environment. While it is important to assess the final outcomes of childhood obesity and weight gain in response to variations in school food environments, it is also important to understand the effectiveness of various policy measures in terms of limiting child consumption or access to unhealthy foods. This is particularly true if policies intended to improve student obesity or BMI outcomes prove ineffective, in which case uncovering the underlying mechanism at work is crucial for a better understanding of how to improve policy measures.[3] In this aspect, this paper is different from most of the past literature on childhood obesity and school food environments. While there are a few studies on school beverage bans and student overall beverage consumption (Fernandes, 2008, Fletcher et al., 2010b, Huang and Kiesel, 2012), this paper is building upon this small exiting literature by estimating the *causal* effect of carbonated beverage restrictions and exploiting heterogeneity in the restrictions by school-level and over time.

The paper starts by discussing the school food environment, highlighting important landmarks in public awareness and its regulations over the last 25 years, with a focus on carbonated beverage policies at schools. Section 3 discusses the main data sources used for this paper: the Nielsen Homescan data and an independently constructed data set on school districts' carbonated beverage policies for 2002–2009. Section 4 discusses the empirical strategy used for the analysis, as well as the identifying assumptions. Section 5 presents the results, followed by Section 6, which presents some of the results' robustness to various alternative specifications. Section 7 interprets the results using data on carbonated beverage consumption in schools. Section 8 provides some concluding remarks.

## 2. School food environment — carbonated beverages

The U.S. Department of Agriculture (USDA) sets federal standards for the provision of foods and beverages on school grounds to students. Nutritional standards on the fat and sugar content of the foods provided, calories per serving, and nutritional composition have always been in place for the provision of lunch and breakfast, as part of the National School Lunch Program (NSLP) and

[2] Just and Price (2013) and French et al. (1997) are examples of studies which evaluate an intervention to promote healthier eating habits only in the setting where the intervention took place. While the input from these interventions is important and informative, the authors themselves acknowledge that it is not possible to assess the overall dietary intake effects of these interventions due to no tracking of individuals' habits outside the intervention setting.

[3] Datar and Nicosia (2012) is an example of an evaluation of limitations in the availability of junk food in schools which proved primarily ineffective.