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Viewpoint: Soda taxes – four questions economists need to address

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Abstract

The popularity of soda taxes as a public health policy has grown rapidly in the last few years. While the evidence that the tax works in reducing the purchases of soda is emerging, there are a number of questions that are yet to be answered before the broader effectiveness of this measure can be determined. Beyond health effects, there is more specifically a need to better understand the economic mechanisms of change, redistributive effects, as well as causal and spillover effects in food systems and economy more broadly.

Keywords: tax; soda; sugary drink; SSB; effect; economic impact

Highlights

- Increasing number of countries are considering or implementing soda taxes
- Taxes are shown to have reduced purchases of taxed sodas
- Better understanding is needed on mechanisms driving change, including media framing
- Taxes incentivising reformulation likely to have different consequences on consumption and revenues
- Health, redistributive and wider economic impacts are yet to be determined

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Introduction

In the last few years the list of countries that have implemented a soda tax, or plan to, has grown rapidly (see table 1). The popularity of this upstream public health policy, designed to reduce consumption of sugar, is exceptional. The first ex-post evaluations suggest soda taxes work in reducing purchases of taxed products (see table 2). In Mexico, the demand for sugary drinks fell by 6-9% in the first two years after implementation of a tax that increased price on average by 10% (Colchero et al., 2017b, Colchero et al., 2015). In Berkley, California, sales data indicated a 9% decline in purchases, while self-reported changes in consumption amounted to a 21% reduction of taxed sodas (Falbe et al., 2016, Silver et al., 2017). In Finland, Hungary and France, although rigorous evaluations have not yet been undertaken, reports also indicate reductions in demand (Cornelsen and Carreido, 2015). Yet, while seemingly straightforward, the effects become complex once we look deeper and wider (Penney et al., 2017). How thoroughly do we understand the direct and indirect mechanisms and effects of these taxes; not only on health outcomes but also on the wider economy? In this viewpoint, we outline four core questions that require greater engagement from economists in the design and evaluation of this health policy intervention to ensure it meets its potential.

1. Mechanism for behaviour change: price or signalling effect?

Implementation of soda tax is generally preceded and accompanied with significant debates in the media between specialists and advocates from both (public) health and the food industry. The former generally focus on the negative health effects of (over) consuming sugar or sodas and its associations with obesity and disease; calling for measures such as the tax and suggesting that revenues, if earmarked for health, nutrition or education, can yield even greater benefits (Niederdeppe et al., 2013, Nixon et al., 2015, Elliott-Green et al., 2016, Jeong et al., 2014). The pro-industry coverage emphasises the importance of consumer choice, individual responsibility and exercise, disassociates the products from negative health outcomes and generally refers to the tax as a regressive measure with negative consequences on the poor, jobs and the economy (Niederdeppe et al., 2013, Nixon et al., 2015, Elliott-Green et al., 2016).

The question therefore arises of whether the price increase that the tax eventually causes (which could both fall short or exceed the expected value of the tax (Berardi et al., 2016, Falbe et al., 2015, Cawley and Frisvold, 2017, Silver et al., 2017, Colchero et al., 2015)), is the main driver for behaviour change, such as observed in Berkeley and Mexico, or the framing of the tax as a health (or economy) related measure, including in the media, has a significant role?

For example, a recent study analysing changes in the sales from a voluntary levy on sugary drinks, implemented in a chain of 37 restaurants in the UK, found a large reduction in the sales (9.3%) relative to a modest increase in price (about 3.5%). However, the levy was supported with different activities, including redesigned beverage menu with text explaining why the levy was introduced, new products on the drinks menu as well as numerous articles in press and a documentary screened in a national TV channel, so it is likely that these other activities also influenced consumer behaviour (Cornelsen et al., 2017).

A study reviewing British mainstream media in 2014 found 374 articles published on sugar-sweetened beverages (more than one article per day). Of these, 81% suggested that these drinks are unhealthy, although only 24% suggested any policy change (Elliott-Green et al., 2016). In the USA, local taxes are being voted for in a ballot which is preceded with explicit campaigns on both sides (Paarlberg et al., 2017) and is likely to raise awareness. Such framing effects are very difficult to measure as the information in media appears over time and starts well before a tax is implemented. However, for

example, a study of a relatively small, 5% sales tax on soft drinks, unrelated to health (Maine (1991) and Ohio (2003)), found no changes in sales arising from this measure (Calantuoni and Rojas, 2015) suggesting also that price may not be the only driver.

A further, related, issue that may determine the effectiveness of the tax is whether, once introduced, the tax is signalled to the consumer on the price tag, shelf price or receipt serving as a reminder of the tax. There is emerging literature (particularly from the USA) on tax salience suggesting that taxes which are posted (signalled) in prices reduce consumption more than increases in sales taxes which are added at the register (Chetty et al., 2009, Chen et al., 2015, Zheng et al., 2013). This issue has not been extensively studied in the context of soda taxes but it relates back to the design of the taxes and at which stage of the supply chain the tax is applied (e.g. if levied on the producer, it is difficult for the retailer to know the exact amount to post on the price).

If taxes indeed are more salient and consumer response stronger when tax is signalled in the posted price, there are important implications to revenue collection from the tax. Simply put, if the aim is to raise revenue, the tax should not be posted and if the aim is to reduce consumption, the tax should be posted and well signalled to the consumer. Contrary to cigarette taxes, the ability of a soda tax to raise revenue is already more limited because the own-price elasticity is greater (in absolute terms) for sodas (estimated at -0.8 to -1.2 by meta-analyses vs -0.4 to -0.7 for cigarettes (Andreyeva et al., 2010, Cabrera Escobar et al., 2013, Green et al., 2013, Jha, 2009, Gallet and List, 2003, IARC, 2011)).

2. Comprehensiveness of the purchasing behaviours: are we getting the full picture?

When it comes to the effectiveness of soda taxes, evidence stems largely from data collected on purchases for at-home consumption (i.e. based on home-scan data). Beyond experimental studies, there is little evidence on how a soda tax influences consumer purchases out-of-home; for example in work places, cafeterias and (fast-food) restaurants. Consumption in these places can be significant. For example, in the USA, consumers' daily average intake from sodas is 213 kcal, of which 135 kcal (74%) is purchased from supermarkets or convenience stores (An and Maurer, 2016) and, likely to be consumed at home. A significant minority is consumed at fast-food restaurants, full-service restaurants, vending machines and other sources. In the UK, a recent study compared beverage consumption by location using the National Diet and Nutrition Survey data from 845 children aged 4-13. All the children reported beverage consumption at home with average soda intake <25g/day. While less than quarter of these children reported consuming any beverages in fast-food or full-service restaurants and cafes, the consumption of sodas was highest in these locations (106g/day and 110g/day, respectively) (Vieux et al., 2017). Going forward it is important to see how soda taxes are passed on to consumers in these other purchase locations and how this may affect purchase and consumption. Understanding these effects would also help understand how complementary policies, such as the ban on vending machines in schools or sales of supersized or fixed-price drinks (e.g. as in France) could affect consumption and diets.

One of the main counterarguments to implementing soda taxes is its regressive nature as low-income households tend to consume more of these beverages (Cornelsen and Carreido, 2015). Because of lower incomes it is likely, however, that low-income consumers are also more responsive to changes in prices so presumably they would also reduce consumption relatively more (Wada et al., 2015), but whether that carries through to proportionally higher health benefits is yet to be demonstrated.

To understand the health effects it is crucial to understand if soda taxes have a broader effect on purchase decisions beyond the taxed products (Cornelsen et al., 2014). Are there substitution, complementarity or budget effects towards untaxed beverages, other sugary products (e.g.

confectionary, biscuits, chocolates, desserts) and healthier foods, such as fruits or vegetables? The existing evaluations from Mexico and Berkley that looked at untaxed beverage alternatives suggest some substitution towards water (see table 2), but broader evaluations of the effects of implemented taxes, exploring substitution within the full food basket (including in longer run) remain to be done.

3. What is the impact of incentivising reformulation versus reduced consumption?

In comparison to taxes implemented thus far in Mexico, France, and in parts of the USA, some recent proposed taxes fundamentally differ, and are more complex. For example, the sugary drinks levy proposed in the UK, has tax rates set at different levels depending on the sugar content in the beverages, and the objective is not to reduce soda purchases *per se* but to reduce the consumption of sugar through giving companies incentives to “remove added sugar, promote diet drinks, and reduce portion sizes for high sugar drinks” as drinks containing less sugar will be taxed at a lower rate or not at all (HM Treasury, 2016a).

And while sodas with high sugar content, in the UK for example, comprise about half of the soft-drinks market, the mid-range category (subject to a smaller levy), is growing and the industry is keen to show its efforts at reformulating (BSDA, 2017). In the anticipation of a number of these efforts, UK government has already had to reduce expectations of revenues raised (Daneshku, 2017). Another uncertainty is whether or not the tax is passed through to the price of sodas, as it is levied upon the producer, not the retailer, who can apply different pricing strategies to its entire product portfolio. This includes changing the prices of non-taxed products also, depending on their projections of consumer demand and price responsiveness.

In evaluating the possible economic impact of such multi-tiered taxes, and/or those targeted at producers not consumers, we need to consider several scenarios that account for product reformulation and replacement, price increases of taxed products and untaxed alternatives, as well as the wider redistributive effects in the economy. In this respect, a useful comparison could be made between the effects observed in Catalonia where taxes are two-tiered but mandatory for retailers to pass it on to consumers (Generalitat de Catalunya, 2017), versus the UK or Ireland where the planned taxes will be levied on producers and pass-through to prices left to the discretion of the manufacturers.

4. What is the impact on the economy more widely?

Even if prices do increase for certain drinks, and their consumption falls as a consequence, the economic impact is ambiguous at best, given substitution patterns across drink and food. Media coverage of soda taxes include threats by the industry of the negative consequences on jobs and company tax revenues from reduced demand (Oxford Economics, 2016). However, much of this debate – on both sides – misses the critical point that even if we do not know on what exactly, it is likely that the money not spent on soft drinks will be spent on other products (be it beverages or food). If the price of soda increases following a tax and consumers substitute to, say, water that is produced by same producer, revenues simply shift rather than fall away (Richardson, 2016). Similarly, if consumers now have three beers rather than two beers and one cola, bar and restaurant revenues might actually increase (and of course health may not). Therefore, *redistributive effects*, both *within* the drinks industry and related businesses and *across* the food and drinks industry at large are likely to occur, albeit possibly only over time.

We also need to look beyond the food and drink industry and consider the wider economy. In the case of the UK levy, the policy also refers to increasing investment in physical activity interventions and healthy school-meals for children. In this case, there may be increased employment in the physical

activity sector, and the associated publicity may further increase demand for health-club membership, trainers or sports equipment (Penney et al., 2017).

Finally, a dimension to consider is geographical effects. For example, the localised taxes in the USA, in relatively small jurisdictions, are likely to see at least some level of increased “cross-border” shopping which in turn will affect tax pass through rates and revenues collected (Cawley and Frisvold, 2017). Is there an optimal geographical spread and magnitude of the tax that would avoid this? More globally, if taxes do work and consumption falls in countries where this measure has been adopted, are we pushing the problem to other markets, particularly those in lower-middle income countries with large growth potential for these types of beverages (Euromonitor Passport, 2015, Goryakin et al., 2017, Roache and Gostin, 2017)? There are lessons to learn here perhaps from the stricter tobacco control policies in high-income countries being associated with increased marketing and consumption in low- and middle-income countries (Savell et al., 2015).

Conclusion: what economists need to analyse

To address the issues above, there are numerous aspects surrounding soda taxes that have or are about to be implemented that urgently need input from the economics discipline to:

- Continue to thoroughly assess the impact of soda taxes, on purchases of both taxed and non-taxed products, including by income gradient and beyond the immediate geographical boundaries of the tax;
- Study the substitution effects in greater detail, using alternative approaches to demand analysis where aggregation of products may mask important patterns;
- Understand the mechanisms of change in current, implemented, taxes and the role of framing the taxes through media debates (or ballots as in the US) and its (synergistic) effects in combination with price changes;
- Conduct a wider analysis of both direct and indirect costs and benefits on the economy arising from the taxes, including arising from reformulation efforts.

In sum, soda taxes are becoming a defining economic intervention within public health, targeting large populations and perhaps second only to measures implemented in limiting consumption of tobacco in the past decades. However, understanding the economic mechanisms and impacts has been scarce while the taxes are now being rapidly implemented without a real consideration of the likely causal and spillover effects in food systems and economy. If this major economic intervention is to achieve its potential, then it urgently requires economists to be involved in grappling with these critical questions.

Table 1. Planned and recently implemented soda taxes

Country	Date	Details
Planned		
United Kingdom	April 2018	Two-tiered levy on producers of sugary beverages. Tax rates are £0.18/L for drinks containing 5-8g of sugar/100ml and £0.24 for drinks containing >8g of sugar/100ml; revenues earmarked for school sports and educational programs (HM Treasury, 2016b)
Ireland	April 2018	Follows proposals of the UK levy (above). Tax rates will be €0.2/L for drinks containing 5-8g of sugar/100ml and €0.3 for drinks containing >8g of sugar/100ml (Department of Finance, 2016)
Seattle (US)	Jan 2018	1.75-cent tax on sodas, sports drinks, energy drinks and other sweet drinks (distributors pay tax) (2017, Norimine, 2017).
San Francisco (US)	Jan 2018	1-cent per fluid ounce excise tax on the distribution of sugar-sweetened beverages. Excludes milk products, 100% juice, diet drinks (Treasurer&Tax Collector, 2017).
Delayed		
Estonia	Intended Jan 2018; delayed	Two-tiered levy on producers of sugary beverages. Tax rates are €0.1/L for drinks containing artificial sweeteners, juices with no added sugar or added sugar up to 8g/100ml; €0.3/L for drinks with > 8g of sugar/100ml. To allow for reformulation the €0.3 rate was initially set with a threshold of 10g of sugar/100ml (2018), then 9g (2019) and 8g by 2020 (Veerman and Thai, 2017, WHO, 2017, ERR, 2017).
South Africa	Intended April 2017; delayed	Implementation of the tax has been delayed and lower, revised tax rates introduced. Tax applies to sweetened beverages with > 4g of sugar/100ml (including pure fruit juices); tax rate is 2.1c per g of sugar in each 100ml beyond 4g/100ml (National Treasury Republic of South Africa, 2016, National Treasury Republic of South Africa, 2017).
Implemented since 2015		
United Arab Emirates	Oct 2017	50% tax on carbonated drinks, 100% tax on energy drinks (Burki, 2017, WCRF, 2017).
Thailand	Sept 2017	Excise tax levied on sugar-sweetened beverages over 6-year phased period to encourage reformulation. Tax rates to be announced; drinks divided into five categories based on sugar content per 100g: below 6g, 6-10g, more than 10-14g, more than 14-18g and more than 18g (Chantanusornsiri, 2017, Jitpleecheep, 2017).
Cook County, IL (US)	August 2017; Repealed Oct 2017	1-cent per ounce tax on sugar-sweetened beverages sold at retail in the County. Exclusions include milk products, 100% juice, diet drinks. The distributor or retailer must include the tax in the sale price of the sweetened beverages (Cook County Government, 2017).
Boulder, CO (US)	July 2017	2-cent per fluid ounce of sugar-sweetened beverage product excise tax on the distributors of the beverages (containing at least 5g of added caloric sweetener per 12 ounce) (City of Boulder, 2017).
Oakland, CA (US)	July 2017	1-cent per fluid ounce excise tax on the distribution of sugar-sweetened beverages containing at least 2kcal/ounce. Milk based beverages and beverages with non-caloric sweeteners are exempt (City of Oakland, 2016).
Saudi Arabia	June 2017	50% tax on carbonated drinks, 100% tax on energy drinks (WCRF, 2017)
Albany, CA (US)	April 2017	1-cent per fluid ounce excise tax on the distribution of sugar-sweetened beverages (defined as containing at least 2kcal per ounce and added sweetener). Exclusions include milk products, 100% juice, diet drinks (City of Albany, 2017).
Catalonia (Spain)	April 2017	Two-tiered tax on drinks that contain added caloric sweeteners. Tax rates are €0.08/L for drinks with 5-8g of sugar per 100ml, €0.12 for drinks with >8g of sugar per 100ml. Tax is mandatory to pass through to sales prices (Baquero, 2017, Agencia Tributaria de Catalunya, 2017, Generalitat de Catalunya, 2017)
Brunei	April 2017	Excise duty of (~\$0.28/L) of SSBs with >6g of total sugar per 100ml (WCRF, 2017)
Portugal	Feb 2017	Special Consumption Tax (VAT). Drinks with <8g of sugar/100ml are taxed at €8.2 per 100L, and drinks with >8g of sugar/100 ml are taxed at €16.46 per 100L. Milk based beverages and natural juices are excluded from the tax. Revenues are earmarked for National Health Service (Agence France-Presse, 2016, The Portugal News Online, 2017, Autoridade Tributaria e Aduaneira, 2017).
Philadelphia (US)	Jan 2017	1.5-cents per ounce excise tax on distributors of sugar-sweetened beverages. Tax excludes milk products, 100% juice, diet drinks (City of Philadelphia, 2017).
Dominica	Sep 2015	10% excise tax to drinks with high sugar content
Barbados	Sep 2015	10% excise tax on sugar sweetened beverages (Alvarado et al., 2017).
Mauritius	Oct 2016	Excise tax of ~\$0.08 per 100g of sugar content in beverages containing sugar, including juices, milk based beverages and soft drinks (WCRF, 2017).

Belgium	Jan 2016	Excise tax (€0.068/L) on all non-alcoholic beverages with added sugar or sweeteners (WCRF, 2017).
Berkley, CA (US)	Jan 2015	1-cent per fluid ounce excise tax on the distribution of sugar-sweetened beverages (containing 2 or more calories per ounce of beverage with added caloric sweetener. Tax excludes milk products, 100% juice, diet drinks (City of Berkeley, 2017).
Chile	Jan 2015	Two-tiered ad-valorem tax on sweetened beverages. An existing 13% tax rate was increased to 18% for high-sugar drinks (> 6.25g of sugar/100ml) and reduced to 10% for drinks below the threshold (WCRF, 2017).

Table 2. Impact of soda taxes on purchases and consumption of beverages

Country	Study	Data	Findings
UK (voluntary levy on sugary drinks in a restaurant chain)	(Cornelsen et al., 2017)	Number of beverages sold per customer using electronic point of sale data records (37 individual restaurants)	At 12-weeks post-levy sales were 11% lower in comparison to 12-weeks pre-levy and at 6-months post-levy, sales were 9% lower. Effects were larger in restaurants with higher baseline purchases of sugary drinks.
Mexico (8% tax on foods high in sugar, salt and fat; peso-per-litre tax on SSB)	(Batis et al., 2016)	Urban household (n=6,248) expenditures on taxed foods, evaluated one year post-tax	5.1% reduction in purchases of taxed foods (10.2% in low-SES, 5.8% in mid-SES and no change in high-SES households); no change in purchases of non-taxed products.
	(Colchero et al., 2016)	Urban household (n=6,253) expenditures on SSBs one year post-tax	6.1% reduction in sales (9.1% among low-SES and 5.5% among mid- and high-SES households). 4% increase in purchases of non-taxed beverages (mainly water).
	(Barrientos-Gutierrez et al., 2017)	Estimation of health impacts using Markov modelling based on (Colchero et al. 2016) estimates of reduction in beverage purchases	Tax modelled to lead to a 2.5% reduction in obesity 10 years post implementation; tax estimated to prevent 86-134K cases of diabetes.
	(Colchero et al., 2017b)	Urban household (n=6,645) expenditures on SSBs two years post-tax	Average reduction of purchases of taxed products was 6.7% in 2014 and 9.7% in 2015. Over the two years, average increase in purchases of untaxed beverages by 2.1%.
	(Colchero et al., 2017a)	National Income and Expenditure Survey (4 rounds) (n=75,954 households)	An average of 6.3% reduction in the observed purchases of SSBs in 2014 in comparison to expected purchases based on trends from 2008-2012. Reductions were higher among low-income households, in urban areas and households with children. A 16% increase in purchases of water observed among low- and middle income households.
Berkley (penny-per-ounce of SSBs)	(Falbe et al., 2016)	Pre- (n=990) and post-implementation (n=1689) survey of self-reported changes in consumption	21% reduction in consumption of taxed beverages; 63% increase in consumption of water.
	(Silver et al., 2017)	Electronic point-of-sale data (15.5m price observations), telephone surveys of (n=957) consumers	9.6% reduction in purchases of taxed beverages, and increased purchases of non-taxed beverages by 3.5% (water 15.6%, juice 3.4%, milk 0.6%); no change in self-reported intake of SSBs but increased intake of calories from dairy-based drinks.

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