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Sugary beverage taxation in South Africa: Household expenditure, demand system elasticities, and policy implications

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ABSTRACT

South Africa faces a severe and growing obesity epidemic. Obesity and its co-morbidities raise public and private expenditures on healthcare. Sugary beverages are heavily consumed in South Africa and are linked to the onset of overweight and obesity. Excise taxation of sugary beverages has been proposed and adopted in other settings as a means to reduce harms from their consumption. A tax on the sugar content of non-alcoholic beverages has been proposed for implementation in South Africa, however, the public health effects and revenue raising potential of this measure hinges on estimates of the targeted beverages own- and cross-price elasticities. This study applies demand system methods by combining expenditure survey data and sub-national price data to provide the first estimates of price and expenditure elasticities for categories of soft drinks that would be subject to South Africa's proposed sugary beverage tax. The results suggest that demand for these products is sufficiently price-elastic such that a significant reduction in consumption may result from a tax.

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1. Introduction

Internationally and in South Africa, public health advocates have called for policies to reduce sugar-sweetened beverage consumption in efforts to reduce the burden of obesity and non-communicable diseases. South Africa faces a severe and growing obesity epidemic. Between 2003 and 2012, the prevalence of obesity among women grew from 27.4% to 39.2%, and from 7.5% to 10.6% among men (Shisana et al., 2013). Contemporaneous to this rise in obesity, South Africa has seen a significant rise in the consumption of processed and ultra-processed foods, including sugary beverages (Igumbor et al., 2012). In 1991 the annual per capita consumption of Coca-Cola products was 132 servings, but had risen to 254 by 2010, placing South Africa among the top 10 global consumers of Coca Cola products (Igumbor et al., 2012).

Sugary beverages (SBs) are non-alcoholic beverages containing added or free sugars that the nutrition epidemiology literature links to a number of adverse health conditions (Hu, 2013). The World Health Organization (WHO) defines free sugars to be any sugar added to foods and drinks by a manufacturer, cook or consumer, and any other sugars not in their natural form (World Health Organization, 2015). Thus, sugary beverages include not only carbonated soft drinks but also fruit juices and some dairy products. Meta-analyses of observational studies and randomized trials have associated consumption of SBs to the onset of not only obesity, but also its co-morbidities including type 2 diabetes mellitus (Malik et al., 2013; Malik et al., 2010; Malik et al., 2006). Beyond obesity and metabolic conditions, the high sugar-content of SBs is also linked to increased incidence of dental caries (Bernabe et al., 2014). The chronic nature of the diseases associated with SB consumption places a significant strain on the already resource-constrained HIV/AIDS-laden healthcare system in South Africa.

Recognizing the ramifications of obesity, the National Department of Health's 2015–2020 Strategy for the Prevention and Control of Obesity in South Africa identified various prevention policies including the implementation of a sugar-sweetened beverage tax. Consequently, the 2016/2017 budget announcement stated that as of April 2017 South Africa would implement a tax on sugar-sweetened beverages.

Various countries have adopted forms of sugary beverage taxation, most prominently Mexico, but also Chile, Denmark, France, Hungary and others. In 2014, Mexico implemented a package of nutrition-focused excise taxes, including a 1 peso per liter specific duty on non-alcoholic beverages with added sugar. Although only recently implemented, evaluations of the tax's impact suggest it has been effective in increasing price and deterring purchase. Analyses of routinely collected price data show the tax was almost exactly shifted to retail prices of the targeted beverages, and for carbonated beverages the tax was over-shifted (Colchero et al., 2015b; Gogger, 2015). An empirical evaluation suggests in its first year the tax induced an average 6% reduction in household SSB purchases, as well as a 4% increase in bottled water purchases (Colchero et al., 2016b). The estimated effect increased through 2014 and by the end of the year had induced a 12% reduction in daily per

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capita SSB purchases (Colchero et al., 2016b). More recent research suggests further reductions in the second year of the tax (Colchero et al., 2016a; Colchero et al., 2017).

Any ex-ante evaluation of the potential effects of such a tax rests on estimates of demand responsiveness to price, otherwise referred to as price elasticity. A price elasticity is a statistic defined as the percentage change in consumption derived from a one-percent change in price (Nghiem et al., 2013). Price elasticities can be own-price elasticities, quantifying the change in demand for a product for a change in that product's price, or alternatively cross-price elasticities quantifying how demand for a product changes when the price of another product changes.

The existing literature on sugary beverage taxes in South Africa is limited to mathematical simulation studies evaluating the health effects of such a tax (Manyema et al., 2015; Manyema et al., 2014). These have drawn on a meta-analysis of studies across multiple countries and settings for elasticity estimates as local estimates were not available (Cabrera Escobar et al., 2013). There is some related literature estimating elasticities for tobacco, alcohol and food products in South Africa, however, at present there are no studies of SB demand elasticities (Agbola, 2015; Alderman and del Ninno, 1999; Case, 1998; Ground and Koch, 2008; Selvanathan and Selvanathan, 2004; Van Walbeek and Blecher, 2015).

This paper seeks to address this gap in the literature. We constructed a novel dataset by combining sub-national price data with the Statistics South Africa Income and Expenditure Survey (IES) 2010/2011. Using this novel dataset we apply standard methods to estimate demand system parameters and to estimate price and expenditure elasticities for a selection of non-alcoholic beverages that would potentially be subject to a tax. The paper proceeds with a description of methods and data, a presentation of the resulting elasticity estimates and a discussion of the policy implications of the results.

2. Methods

To estimate price elasticities of relevant products, we adopt an approach based on the Almost Ideal Demand system developed originally by Deaton and others (Banks et al., 1997; Deaton and Muellbauer, 1980a, 1980b). This demand system approach derives relationships between the share of expenditure on a product on its price and the prices of other products and the total value of expenditure being undertaken by households. Based on these relationships, a system of regressions is estimated and elasticities calculated, as described in greater detail in the Appendix.

We combine detailed household-level expenditure data drawn from Statistics South Africa's Income and Expenditure Survey (IES) 2010/2011, and regionally disaggregated average product price data collected by Statistics South Africa's Consumer Price Index (CPI) unit, to estimate a system of regressions of products' expenditure share on all included products' prices, controlling for household characteristics. In addition, the particular approach adopted here accounts for the censoring arising from a significant prevalence of zero expenditures reported by households. As CPI data are largely collected in urban areas, we restrict our IES sample of households to only urban households.

We limit our system to include sugary beverage products potentially subject to the proposed tax, other non-alcoholic beverages, and sugar. The six product categories in the demand system are: (1) carbonated soft drinks, (2) concentrates, (3) fruit juice, (4) tea and coffee, (5) milk, and (6) sugar. While other sugary beverages do exist in the South African setting, including energy drinks, sports drinks, iced teas and others, expenditure and price data were not collected on those items and therefore could not be included in this analysis. However, as those beverages represent a very small share of the soft drink market, their exclusion is not of significant consequence (Euromonitor, 2015). In addition, data limitations prevented us from being able to distinguish regular and diet (artificially sweetened) beverages particularly among carbonated soft drinks (CSD). However, diet beverages take up a very small portion of the non-alcoholic beverage market (Euromonitor, 2015).

To test the robustness of our approach, we estimate various other specifications of the demand system. This includes, testing the utilization of other household variables as controls, combining fruit juice and CSD into a single sweetened soft drink variable, and including junk foods as a part of the demand system. We make the results of these analyses available in supplementary tables. While there is some minor variation in the resulting point estimates, the results are consistent with our main specification presented in this paper.

Table 1
Descriptive statistics.

Demographic characteristics	Mean	95% CI	Economic characteristics	Mean	95% CI
Household size	3.512	[3.468, 3.556]	Monthly income	12,587.957	[12,147.53, 13,028.39]
Female household head	0.344	[0.335, 0.353]	Monthly consumption expenditure	9878.861	[9477.671, 10,280.05]
Black household head[a]	0.674	[0.664, 0.684]			
Colored household head	0.115	[0.110, 0.120]			
Asian household head	0.037	[0.033, 0.041]			
White household head	0.173	[0.164, 0.182]			

Product category	Mean	95% CI	Mean	95% CI
	Mean monthly expenditure (2011 ZAR)		Mean price (2011 ZAR/liter)	
Carbonated soft drinks	37.488	[36.111, 38.865]	19.557	[19.532, 19.582]
Concentrates	5.458	[5.017, 5.899]	4.212	[4.201, 4.223]
Fruit juices	14.386	[13.61, 15.162]	13.72	[13.705, 13.735]
Tea & coffee combined	12.977	[12.282, 13.672]	0.731	[0.730, 0.732]
Milk	46.336	[44.839, 47.833]	9.477	[9.469, 9.485]
Sugar	25.454	[24.611, 26.297]	9.121[b]	[9.109, 9.133]
	Prevalence of non-zero expenditure		Mean of non-zero expenditures (2011 ZAR)	
Carbonated soft drinks	0.54	[0.53, 0.55]	69.46	[67.28, 71.64]
Concentrates	0.13	[0.12, 0.14]	40.81	[38.24, 43.38]
Fruit juices	0.25	[0.24, 0.26]	58.25	[55.98, 60.52]
Tea & coffee combined	0.21	[0.2, 0.22]	61.77	[59.5, 64.04]
Milk	0.61	[0.6, 0.62]	75.35	[73.26, 77.44]
Sugar	0.44	[0.43, 0.45]	58.35	[56.88, 59.82]

Notes: IES 2010/2011. N = 13,364 (limited to urban residents only).
[a] We refer to population group designations standard in South Africa, with Black referring to individuals of African ancestry, Colored of mixed ancestry, Asian of Asian ancestry and White of European ancestry.
[b] Sugar price is in 2011 ZAR per kilogram.

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