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Containing big soda: Countering inducements to buy large-size sugary drinks[☆]Paul W. Dobson^{a,*}, Ratula Chakraborty^a, Jonathan S. Seaton^b^a Norwich Business School, University of East Anglia, Norwich NR4 7TJ, UK^b Loughborough University, Loughborough LE11 3TU, UK

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ABSTRACT

Health concerns about overconsumption of large portions apply to a wide range of highly calorific foods and drinks. Yet, amongst all products, sugar-sweetened soft drinks and especially sugared soda are the ones which seem to raise the most ire because they contain little or no nutritional value beyond their sugar content and because of the way that vendors encourage excessive consumption by pricing jumbo-size portions to look like bargains while making smaller portions appear overpriced. This paper considers the logic of such extreme value size pricing and reveals why this marketing practice can harm economic welfare beyond public health concerns. The paper shows why policy interventions, including portion cap rules and soda taxes, seeking to reduce portion sizes and curb the consumption of large-size sugary drinks might fail when they do not fully take into account or appreciate the strategic responses that vendors might adopt to retain value size pricing.

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1. Introduction

Menus with different portion sizes can pose a dilemma for consumers. Consumers like choice but choosing between options often involves weighing up complex trade-offs. Faced with the choice between buying sugared soda at \$1.79 for a 16-ounce cup or \$2.39 for a 32-ounce cup, which one should the consumer buy? The smaller one might be enough to quench your thirst, but the larger one offers much more for the money. The larger one might boost your energy levels and make you feel more satiated, but the smaller one has only half the calories and can help keep your weight in check. In weighing up these trade-offs you might be leaning towards buying the smaller one, but would you choose differently if instead the respective prices were \$1.79 and \$1.99? You could, of course, consider buying the larger size but have in mind not consuming all of it, but are you sure that you will keep to this intention once you start drinking?

Relative prices can influence the portion size choice and tip the scales one way or the other because all consumers seek value for money from purchases. However, the differences between consumers in their perceptions of the value on offer helps explain why this choice is presented in the first place. The vendor would not offer different sizes if all consumers thought the same way, other than using one size

as a decoy to frame the offer price on another size and capture all the sales. Yet, consumers do differ in how they evaluate the value on offer and also at different times according to their changing needs and moods. How best then should the vendor price different sizes to appeal to different sorts or moods of consumers? The evident answer, as clear from its ubiquitous application amongst food and drinks vendors, is by the judicious use of quantity discounts with so-called value size pricing (also known as non-linear pricing or supersized pricing) in structuring prices such that the per unit cost (e.g., price per ounce) decreases as portion size increases (Harnack & French, 2003; Haws & Winterich, 2013; NANA, 2002). Value size pricing can be a profitable strategy even to the point of selling different sizes with virtually no price difference (Dobson & Gerstner, 2010).

Bargain offers on large sizes can be irresistible to some consumers and require real determination and discipline for others to turn down alluring offers and stick to a smaller size. Resistance becomes harder the bigger is the discount, but equally the less healthy the product then the greater might consumers try to resist, encouraging the vendor to be even more generous with the size discount. Accordingly, consumers might find the greatest size discounts on the least healthy kinds of foods and drinks. Value-seeking consumers might welcome the offer of large quantities of tasty food and drink at bargain prices. Unfortunately, though, the health consequences for the individual and in aggregate for society could be dire if excessive consumption leads to obesity and ill-health arising from a poor diet. Indeed, the consumption of excessive portion sizes appear to be a significant contributory factor to the alarming rise in obesity levels and resulting healthcare costs to society (Chandon & Wansink, 2011; Rolls, 2003; Steenhuis & Vermeer, 2009; Young & Nestle, 2002) and the availability of enlarged portion

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sizes encourages overconsumption (Hollands et al., 2015; Zlatevska, Dubelaar, & Holden, 2014).

Morgan Spurlock's 2004 documentary *Super Size Me* drew considerable public attention to the health dangers associated with supersizing portions sizes and the upsizing selling methods of McDonalds. Despite McDonalds subsequently withdrawing supersize portions, much of the eating out sector continues to use value size pricing and quantity discounting on large portion sizes across a wide range of prepared foods and beverages (NANA, 2002; Young & Nestle, 2007; Wu & Sturm, 2013).

Health concerns apply to overconsumption on a wide range of highly calorific foods and drinks, but sugar-sweetened soft drinks are now the primary target for policymakers seeking to stem the obesity crisis (Nestle, 2015). This paper focuses on these products and considers why vendors use value size pricing, why this pricing practice might harm economic welfare beyond public health concerns about excessive consumption, and whether particular policy measures are likely to be effective in altering the choices presented to consumers to allow for reduced consumption and improved economic welfare.

2. Policy issues and research challenges

Sugar-sweetened beverages have a range of healthcare concerns beyond general obesity-related medical conditions, including diabetes and dental decay. A 20-ounce soda contains around 17 teaspoons of sugar and upwards of 240 cal, while a 64-ounce fountain cola drink could have up to 700 cal (Nestle, 2015). Research shows that people who drink sugary drinks do not feel as full as if they had eaten the same calories from solid food and do not compensate by eating less (Pan & Hu, 2011). The single-largest source of calories in the American diet in 2010 was sugary drinks, accounting for 46% of all added sugars consumed, while food and beverage companies spent more than \$800 million for marketing sugary beverages in 2013 and U.S. households bought \$14.3 billion worth of these products through stores alone (CSPI, 2015). While the average American buys a whopping 170 l of soda in the course of a year, the U.S. is far from alone in having high per capita consumption and sugary drinks consumption is now a worldwide public health concern (Nestle, 2015). Globally, sugary drinks could be responsible for 184,000 deaths resulting from increased rates of type-2 diabetes, heart disease, and cancer (Singh et al., 2015).

Measures to rein in the consumption of sugary drinks are the subject of much policy debate. The two most high profile contemplated measures are a large-size soda ban limiting the size of containers for sugary drinks (such as the unsuccessful attempt to introduce a Sugary Drinks Portion Cap Rule in New York City to limit cup sizes to a maximum of 16 fluid ounces), and a soda tax in the form of either a sales tax or a per unit excise tax applied to sugary drinks (with Britain and South Africa set to follow the lead of Mexico, France and Hungary). Other proposals targeting consumption of large-size sugary drinks range from highly interventionist measures like direct price regulation to oblige vendors to use proportional pricing through to raising consumer awareness about the dangers of overconsumption through hard-hitting advertising campaigns and overt calorie labelling requirements (Chandon & Wansink, 2012).

A critical issue in devising appropriate policy is to consider the strategic response by vendors to interventions which challenge their profitability. This paper addresses this issue by modelling how a drinks vendor determines its size range and price structure. The modelling shows why policy interventions may have non-linear effects and how accounting for vendor strategic responses can help ensure that measures achieve their intended purpose.

Libertarians may take the view that public health policy interventions which interfere with the free market and individuals' consumption choices amount to unnecessary nanny state interference. Yet, obesity creates a social burden in raising healthcare costs

which impact taxpayers and not just the individual (The Economist, 2012). The negative externalities argument alone can give sufficient justification for public health interventions to tackle obesity. However, building on Dobson and Gerstner (2010), this paper provides a further reason on economic welfare grounds to justify policy interventions that specifically target the consumption of large-size sugary drinks. This justification is because vendors may use value size pricing as an instrument to segment consumers in a fashion that is profitable even if the practice destroys social value when the difference in willingness to pay for a large-size drink over a more moderate smaller size is less than the difference in supply costs. The analysis here shows that policymakers should not underestimate the determination of vendors to profitably segment consumers and that poorly designed measures which do not fully take this aspect into account can damage rather than improve economic welfare.

The plan for the rest of the paper is as follows. Section 3 sets out a parsimonious model to show why a vendor might use value-size pricing to sell sugary drinks. Section 4 derives the vendor's optimal selling strategy. Section 5 shows why value size pricing can be socially inefficient even if privately profitable. Section 6 why policy interventions might not succeed in reducing consumption and improving economic welfare. Section 7 presents the conclusion.

3. Model set-up

The purpose of the model is to explore how a vendor might use different sizes of sugary drinks with different relative prices to target different consumer segments and then consider how policy measures might alter the vendor's behavior and affect consumer choices. The focus is on drinks for immediate consumption with purchase and consumption decisions closely aligned and in a simple setting where a profit maximizing vendor decides between offering one or two different sized drinks and how much to charge consumers for them. The vendor could be any type eatery or outlet selling drinks in cups or glasses for immediate consumption.

The vendor offers as a base choice a regular portion size (say, 16 oz) that allows consumers to drink in moderation at a price p and at a unit cost of supply c . In addition or alternatively, the vendor could offer a bigger size and decide on the price, P , for this large size (say, 32 or even 50 oz) with unit cost of supply C . If offering both sizes, the vendor determines the price difference for the large size over the regular size, denoting $\Delta p \equiv P - p$, while taking account of the unit cost difference, denoting $\Delta c \equiv C - c$. Other costs are fixed and do not affect the vendor's decisions.

The vendor faces two types of consumers: θ Value-Conscious consumers and $1 - \theta$ Health-Conscious consumers, where $0 < \theta < 1$ so normalizing the total number of consumers to equal unity. Denoting V as the Value-Conscious consumers and H as the Health-Conscious consumers, customers of type i , where $i = V, H$, are willing to pay u_i for the standard regular size and U_i for the large size. The difference in these valuations for each consumer type is $\Delta u_i \equiv U_i - u_i$, reflecting how much they gain from trading up from the regular size to the large size.

This bifurcation of consumer segments into value-conscious and health-conscious highlights in plain terms how different consumers, or the same consumers but in different circumstances, make purchasing choices over the amount of appealing-but-unhealthy food and drinks to consume where the value on offer for large sizes tempts some consumers, but health concerns help restrain other consumers to avoid excessive consumption of such goods. Empirical studies provide support for this distinction, showing that price-oriented consumers have a greater propensity to be overweight than less price-conscious consumers (Gandal & Shabelansky, 2010) and that obesity and unhealthy food and drink consumption rates tend to be higher amongst lower income consumers (Drewnowski &

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