



# Tax incidence with strategic firms in the soft drink market



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## ABSTRACT

Because soft drink (SD) consumption is considered to be a contributor to the ‘epidemic’ of obesity, there is a growing interest in evaluating the impact on SD consumption of alternative tax policies. In this paper, we propose a methodology to evaluate the impact of taxation of a food market taking into account the strategic price response of both manufacturers and retailers. We apply this methodology to the French SD market and simulate the impacts of ad valorem and excise taxes. We find that firms behave differently when facing an ad valorem tax or an excise tax. An excise tax is overshifted to consumer prices while an ad valorem tax is undershifted to consumer prices. We find that an excise tax based on the sugar content of SD is the most effective at reducing SD consumption. Our results also indicate that ignoring strategic pricing by firms leads to misestimations of the impact of taxation by between 15% and 40% depending on the products and the tax implemented. In the short-term, that is, ignoring positive long-term health effects, a €9 cents/l excise tax has a small negative welfare effect (about €1/person/year).

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## 1. Introduction

According to the World Health Organization, noncommunicable diseases, mainly cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes, cause about 35 million deaths each year, representing about 60% of all deaths.<sup>1</sup> Moreover, up to 80% of the incidences of heart diseases, strokes, and type 2 diabetes and over a third of cancers could be prevented by eliminating shared risk factors, mainly tobacco use, unhealthy diet, physical inactivity, and the harmful use of alcohol. A healthier food diet could be reached by reducing salt levels, eliminating industrially produced trans-fatty acids, decreasing saturated fats, and limiting free sugars. A related consequence of unhealthy diet and physical inactivity is the rise in obesity prevalence.

To tackle this public health problem, governments have tried to use public information campaigns with the aim of getting people to change their food habits. These information campaigns may have positive impacts on food consumption (Weiss and Tschirhart, 1994; Snyder, 2007). However, they seem to have not been sufficiently

effective at changing behaviour (Cutler et al., 2003), and have failed to reverse the rising trend in obesity, diabetes, and heart diseases. In other areas, legislation and taxation have proved more effective (e.g., in the cigarette market, Chaloupka and Warner, 2000). Until now, tax (subsidy) policies designed to promote healthier food choices are almost unused. However, as they have been shown to be effective for the cigarette market, they might be considered as tools to influence consumer behaviour to improve diets and therefore public health.

As the link between food intake and health is more and more recognised, there is a growing interest in the ex-ante analysis of the health impacts of alternative food price policies (for a review, refer to Thow et al., 2010). More recent contributions include Purshouse et al. (2010), Dallongeville et al. (2011), Allais et al. (2010), Bonnet and Réquillart (2011), and Griffith et al. (2010). However, most of these analyses assume passive pricing; that is, producers and retailers are supposed not to adjust product prices in response to the tax (subsidy) policy. The only example of a paper integrating strategic pricing is Griffith et al. (2010), who account for strategic behaviour at the manufacturer level. Both the food industries and the retail chains are characterised by large firms with market power, and therefore taxes are unlikely to be perfectly passed through to consumers.<sup>2</sup> The empirical industrial

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<sup>1</sup> World Health Organization, 2008–2013 Action Plan for the Global Strategy for the Prevention and Control of Noncommunicable Diseases. [http://whqlibdoc.who.int/publications/2009/9789241597418\\_eng.pdf](http://whqlibdoc.who.int/publications/2009/9789241597418_eng.pdf) (accessed 2010, December 17).

<sup>2</sup> We define the pass-through of the tax as the ratio of the price change and the amount of the tax.

organisation literature on pass-through of upstream cost changes concludes that there is imperfect pass-through (Goldberg and Verboven, 2001; Hellerstein, 2008; Bonnet et al., 2013; Nakamura and Zerom, 2010). A major explanation is the markup adjustment of manufacturers and retailers due to consumer substitution patterns, market structure, and market power in industries. Overall, this literature suggests that final food prices are likely to be adjusted in response to a tax (subsidy) policy.

In this paper, we study the impact of taxing soft drinks (SDs) because there is strong evidence that consumption of SDs is a contributor to the 'epidemic' of obesity (Harnack et al., 1999; Malik et al., 2006). Moreover, the industry is highly concentrated at both the processing and retailing levels, making the possibility of strategic pricing more likely. The originality of our approach is to consider competition among a large number of brands and to integrate in the analysis strategic pricing of a vertical chain of oligopolies. This paper uses structural econometric models that integrate consumer substitution patterns and account for horizontal and vertical interactions between manufacturers and retailers as in Berto Villas-Boas (2007) and Bonnet and Dubois (2010). We quantify the impact on prices, market shares of the different SDs, household consumption, and welfare of alternative taxation schemes in France.

In Europe, some countries have recently introduced taxes on SDs or more generally on unhealthy foods. In 2011, Hungary introduced taxes on manufactured goods that contain sugar, including carbonated sugary drinks. In Finland, the excise tax on SDs was raised from €0.045 to 0.075/l in 2011. Finally, in France, a €0.0716/l tax on SDs, whether they are sugar-based or diet, was introduced in January 2012.<sup>3</sup> However, we do not evaluate the impact of this new tax because SDs are taxed whether they are sugary or diet. Rather, we consider different designs for the tax in order to compare their effectiveness and provide a more general analysis of the impact of alternative taxes on this market. Thus, we evaluate the impacts of an excise tax based on the sugar content, an ad valorem tax based on the sugar content, and a uniform ad valorem tax. We find that firms behave differently when facing an ad valorem tax or an excise tax. Ad valorem taxes are undershifted to consumer prices while excise taxes are overshifted to consumer prices. In the latter case, strategic pricing amplifies the impact of taxation on final consumption. Among the different tax systems analysed in this paper, the excise tax based on the sugar content has the largest impact on SD consumption and added sugar consumption. According to our quantitative results, ignoring strategic pricing by the industry leads to a misestimation of the impact of taxation on consumption by about 15%–20% for regular products and 30%–40% for diet ones. This strongly militates for integrating strategic pricing in the ex-ante analysis of food taxation. Our results suggest that an excise tax is superior to an ad valorem tax from a welfare point of view. The short-term welfare effect of the tax is negative but remains small (about €1/person/year for a €0.09 tax per litre of SD).

The paper is organised as follows. Section 2 gives a brief review of the related literature. Section 3 presents the main characteristics of the SD industry. Section 4 introduces the data and descriptive statistics about SD consumption. Section 5 describes the model used to analyse the demand and the method used to simulate the impacts of taxation, taking into account vertical relationships between manufacturers and retailers. Section 6 discusses demand and supply results. Section 7 provides results of alternative scenarios of taxation and Section 8 concludes.

## 2. Background literature

Public policies aiming at reducing SD consumption might be justified by the following arguments. The first argument points out that

<sup>3</sup> Initially, the French government proposed a tax on sugar-sweetened SDs and argued that it would help combat obesity. Representatives of the food industry strongly opposed the targeting of the tax. They did not accept the idea of an 'obesity' tax and preferred that the tax also apply to all products, including diet ones.

there are negative externalities associated with SD consumption due to the higher health care costs for obese people in a context in which those costs are borne by all taxpayers. A second argument, perhaps the main argument for SD taxation, notes that there are long-term (negative) impacts of excessive consumption on individuals' own health. Thus, excessive consumption is associated with higher obesity rates and obesity has negative health impacts. In this context of delayed impact, if consumers do not have 'correct' knowledge of the health impact of their present consumption, there is room for 'paternalistic' policy. This relates to the literature on sin goods, where the consumption of a good provides utility in the first period but has a negative impact in the second period. Thus, O'Donoghue and Rabin (2006) showed that, in an economy with heterogeneous agents and in which some individuals have time-inconsistent preferences, a tax policy is welfare-enhancing. Cremer et al. (2012) extended the analysis, integrating the possibility that the agents can mitigate the impact of their past consumption decisions. Whether consumers realise or not in the second stage that they have based their decisions on wrong premises, the authors show that the planner has to tax the consumption of the sin good.

An important issue in appraising taxes is their transmission to consumer prices. In the following we consider ad valorem taxes and excise taxes. An ad valorem tax is defined as a percentage of price; a typical example is VAT (value added tax). An excise tax is a per unit tax. A major difference between the two types of taxes is that an ad valorem tax grows with price whereas an excise tax does not. The theoretical literature suggests that an ad valorem tax is less likely to be overshifted than an excise tax in a context of quantity competition (Stern, 1987; Delipalla and Keen, 1992) or price competition (Anderson et al., 2001). The literature also shows that conditions for overshifting of a tax are related to conditions related to the elasticity of the slope of the demand curves. The empirical literature on the impact of taxation in the cigarette industry provides evidence that excise taxes are slightly overshifted to consumers (Barnett et al., 1995; Keeler et al., 1996; Hanson and Sullivan, 2009). Moreover, Delipalla and O'Donnell (2001) found that in most EU countries the excise tax is more fully transmitted to the final consumers than is the ad valorem tax.

The analysis of how consumers react to the taxes on cigarettes also provides some interesting insights for the analysis of the impact of a tax on SDs. First, Evans and Farrelly (1998) showed that consumers might substitute among differentiated products, a reaction that should be taken into account in the analysis of SD taxation. A second lesson is related to the regressivity of the tax when individuals are time-inconsistent. As soon as the rate of consumption of a good does not strongly differ among the population, an excise tax is very likely to be regressive (the worst situation is when the rate of consumption decreases with the income level). This is true whether the product is addictive or not. As shown by Becker and Murphy (1988) with rational addiction, there is no difference between an addictive and a non-addictive good with respect to the incidence of taxation. However, as soon as individuals are time-inconsistent, this result is no longer true. As shown by Gruber and Köszegi (2004) with time-inconsistent individuals, taxes play a self-control function that benefits the more price-sensitive group. When people with lower incomes are more price sensitive than the regressivity is lower than expected.

According to Malik et al. (2006, p. 274), who conducted a review of the link between sugar-sweetened beverages and weight gain: "sufficient evidence exists for public health strategies to discourage consumption of sugary drinks as part of a healthy lifestyle." Fletcher et al. (2010) studied the impact of SD taxation on consumption, exploiting the heterogeneity of the tax rate across states and across time in the US.<sup>4</sup> They found that taxes lead to a slight reduction in SD consumption by children and adolescents. The impact on sugar consumption was found to be weak, as part of the decrease in consumption is offset by

<sup>4</sup> Thus, in 2009, 33 states levied sales taxes on sodas at an average rate of 5.2% (Smith et al., 2010).

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