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The impact of a ‘soda tax’ on prices: Evidence from French micro data

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Résumé: A partir d'une base de données constituée de plus de 500,000 observations sur le prix de boissons non alcoolisées, nous évaluons l'impact de la 'taxe soda', instituée depuis le 1er Janvier 2012 en France. L'approche retenue, en "différence de différences", nous permet de montrer que la taxe a progressivement été répercutée dans le prix des boissons contenant du sucre ajouté ou des édulcorants. Six premiers mois après son introduction, la taxe était totalement répercutée dans le prix des sodas et presque totalement pour les boissons aux fruits, tandis que de façon partielle pour les eaux aromatisées. Nous montrons également que l'impact de la taxe sur les prix a été différent selon les marques de boissons et les groupes de distribution.

Mots-clés: Taxe d'accise, boisson, sucre ajouté, incidence, ajustement de prix

Codes JEL: E31, D40

Abstract: Based on an original data set of more than 500,000 non-alcoholic beverage price records, we evaluate the impact on consumer prices of the 'soda tax', an excise on drinks with added sugar or sweetener, introduced in January 2012 in France. We adopt a difference in differences approach and find that the tax was gradually passed through. 6 month after its introduction the tax was fully shifted to soda prices and almost fully shifted to prices of fruit drinks, while the pass-through for flavored waters was incomplete. We also find that the pass-through was heterogeneous across brands and retailing groups.

Keywords: soda tax; pass-through; tax incidence; excise tax.

JEL classification: E31, D40

1 Introduction

Since January 2012 a ‘soda tax’ has been introduced in France, based on the claim that drinks containing added sugar or sweetener are unhealthy and that their consumption should be discouraged. A similar tax already existed in some countries, like Denmark, Finland and Hungary and in many US states (OECD, 2012; Bridging the Gap Program, 2011). The excise concerns all non-alcoholic beverages with added sugar or sweetener, like sodas, but also flavored waters and fruit drinks. It amounts to 7.16 cents per liter,¹ but a full pass-through of the soda tax would amount to a price increase of 7.55 cents per liter, given that VAT applies to the excise.

The aim of this paper is to evaluate the impact of the French soda tax on the price of the three main product categories of concerned drinks: (i) flavored waters, (ii) fruit drinks and ready-to-drink teas, and (iii) sodas (including colas, energy, tonic and other soft drinks). Because the tax was not necessarily immediately and fully shifted to prices, our analysis allows for gradual price reactions over time. We also consider the possibility of heterogeneity in the tax pass-through across retailing groups and beverage brands.

This paper contributes to the still sparse literature on the impact of sugar sweetened beverage (SSB) excise taxes on prices. Despite the increasing interest in the impact of SSB taxes on soft drinks consumption and, consequently, on health or obesity (e.g., Brownell et al. 2009; Dharmasena and Capps, 2012; Finkelstein et al., 2013; Jacobson and Brownell, 2000; Lin et al., 2010; Smith et al., 2010; Fletcher et al., 2010), there is still little evidence regarding the impact of an SSB tax on soda prices. Actually, most often the impact of a soda tax on obesity and health has been simply estimated under the assumption of full pass-through of the tax to prices.

The theoretical literature regarding the impact of excise taxes on prices in markets with perfect competition is unambiguous: in standard cases (i.e., upward sloping supply curve and downward sloping demand), the tax is under-shifted to prices (i.e., prices increase by less than the tax). In particular, the smaller the elasticity of demand and the larger the elasticity of supply, the larger the pass-through of the tax to prices. Only if demand is totally inelastic or if the supply curve is infinitely elastic (i.e., marginal costs are constant), the tax is fully passed-through to prices (Fullerton and Metcalf, 2002). However, when goods are sold on markets where imperfect competition prevails, depending on the characteristics of demand and on those of production costs, excise taxes may be either under-shifted, fully shifted or even over-shifted to prices.

Since non-alcoholic beverages can be considered highly differentiated products, no-

¹Law number 2011-1977, passed on December 28th, 2011 (the government initial project was to set the tax at 3.58 cents per liter and only for beverages with added sugar).

tably differing from each other in terms of taste and quality and since we focus on the impact of the soda tax on prices over the months just following its introduction, we may here restrict our attention to results regarding the short-run impact of excise taxes on prices on markets with differentiated products.² Anderson et al. (2001) show that in the case of differentiated products, if firms compete in prices and if the elasticity of demand is constant, an excise tax is over-shifted to prices. Taking into account product differentiation in a context of spatial competition (i.e., the intensity of competition is stronger with firms selling ‘close’ products than with those selling ‘far distant’ products), Fullerton and Metcalf (2002) show that an excise tax is fully passed-through to producer prices and over-shifted to consumer prices (as long as an ad valorem tax also applies).

Are theoretical predictions corroborated by existing empirical studies regarding the impact of SSB taxes on prices? The few empirical assessments of the pass-through of a soda tax to prices available until now suggest that the soda taxes would rather be over-shifted to prices. Bergman and Hansen (2013) evaluate the impact of various excise tax variations on alcoholic and non-alcoholic beverage prices in Denmark. Based on the analysis of micro price data used by Statistics Denmark to compute the Danish Consumer Price Index, they conclude that the two increases in the soft drink tax that occurred in 1998 and 2001 were strongly over-shifted to consumer prices. Using a quite different approach, Bonnet and Réquillart (2013) come to the same conclusion. They specify a structural model where competition is horizontal (among producers on the one hand and among retailers on the other hand), as well as vertical (between producers and retailers) and show using simulations that an excise SSB tax is likely to be over-shifted to prices.

Beyond these two studies, a few empirical studies consider the more general question of the impact of specific consumption taxes on prices. Besley and Rosen (1999) have considered the impact of sales taxes on a large number of products in US. They also outline an over-shifting of these taxes to soda prices. Doyle and Samphantharak (2008) find under-shifting of gasoline sales tax changes, while Marion and Muehlegger (2011) find full pass-through in the US. Carbonnier (2007) shows that French VAT changes in the new car and housing repair services sectors were under-shifted. The conclusions that can be drawn from other studies devoted to the impact of excise taxes on prices of alcoholic beverages or cigarettes are also diverse. Although Kenkel (2005) and Young and Bieliska-Kwapisz (2002) also conclude to over-shifting of taxes to alcoholic beverage prices, as do Hanson and Sullivan (2009) regarding cigarette prices, De Cicca et al. (2013) find full shifting while Chiou and Muehlegger (2010) and Harding et al. (2012) find under-shifting.

²It is also important to distinguish between short-run and long-run effects as, in the long run, firms entries and exits affect the tax impact on prices (see Stern, 1987; Delipalla and Keen, 1992; Anderson et al., 2001).

In order to evaluate the extent of the pass-through of the French soda tax to prices, we apply a difference in differences approach to an original data set made of about 52,000 price trajectories. Each trajectory refers to a non-alcoholic beverage (defined by its brand, quantity, packaging, etc. and individually identified by its bar code) sold in a specific shop (defined by its name, retailing group, and address). Overall, the prices of 845 different beverage products sold in one or more of the 760 supermarkets present in the data set are followed from August 2011 to June 2012.³

We find that, after 6 months, the tax was fully shifted to soda prices, while there was a significant under-shifting of the tax to prices of flavored waters and a slight one to prices of fruit drinks. Notice that the preponderance of sodas sales among the non-alcoholic beverages liable to the tax suggests a quasi-full shifting of the excise to beverage prices at the macroeconomic level, supporting the full shifting assumption often made in studies about the impact of SSB taxes on the consumption of soft drinks. Moreover, our results point to a significant heterogeneity of the soda tax pass-through not only across product categories, but also across retailing groups as well as across beverage brands. In particular, the average quasi-full shifting of the tax results from the combination of an over-shifting for private labels and small producers' brands (at least for fruit drinks) and of an under-shifting of the tax in the case of large producers' brands. At the same time, we find that the two main retailing groups in France often passed through the soda tax less than the other ones. These results are shown to be consistent with a simple producer-retailer bargaining framework.

The remaining of the paper is structured as follows. Detailed presentations of the data and empirical strategy are provided in Sections 2 and 3, respectively. Section 4 is devoted to the presentation of the results regarding the average magnitude and timing of the pass-through, while Section 5 contains a discussion of the heterogeneity of the pass-through across brands and retailers. Section 6 concludes.

2 Data

Our analyses of the impact of the soda tax are based on data collected by Prixing, a start-up that developed a price comparator available on mobiles and on the internet. Prixing developed automatic procedures allowing the collection of price lists from 'drives'. A drive is a place where you collect goods you have previously ordered on the internet. Most drives are associated with a supermarket, but there are also a few 'stand alone' drives ('warehouse-drives' / 'drives-entrepôt' in French). This form of retailing gained in

³These data were collected and made available to us by Prixing, a start-up company providing consumers with a free mobile price comparator (see <http://www.pricing.fr/>).

importance since 2010 in France: there were around 500 drives in France at the end of 2010, their number doubled by the end of 2011, to reach almost 2,000 by the end of 2012 and about 2,700 by the end of 2013 (Dauvers, 2013a, 2013b). This new retailing channel differs from the usual internet retailers in two respects: customers have to go to the drive to collect the purchased goods and, more importantly for our analysis, prices are exactly those that customers would pay, would they go and buy the same product in the physical store associated with the drive.⁴

Although the range of products available in a drive is a bit smaller than that available in the associated physical store, it is still considerable. On average, about 10,000 products are available to customers in drives, ranging from 3,000 products in the smallest ones up to 25,000 in the largest ones (Dauvers, 2012). This has to be compared with the number of products offered in supermarkets, which ranges between 5,000 and 10,000 for small supermarkets and reaches between 30,000 and 100,000 in hypermarkets (i.e., outlets with a selling space of at least 2,500m²).⁵ The list of products available in drives thus represents a quite significant fraction of those available in supermarkets and its structure broadly corresponds to that of products available in supermarkets, i.e., with a strong predominance of food products (almost two thirds of collected prices), non-durable household goods such as washing-up liquid or dishwasher detergent (around 12%) and personal care products (around 10%). Prices of clothes and household appliances are also recorded though for a much more limited number of items.

The initial data bases we were given access to contain prices regarding more than 135,000 products sold in about 1,800 drive outlets, i.e., almost the total population of drives that existed in mid-2012 in France. The average number of products for each drive in this data set is about 9,000. Altogether, this represents about 80 millions price spells⁶ covering the period between March 2010 and September 2012.⁷ Unfortunately,

⁴One of the major retailing chains in France recently tried a different pricing strategy whereby a few products are sold at a cheaper price in some drives than in the associated supermarkets. However, this practice was not yet implemented at the time of the collection of the data we use here. More in general, it may happen that some discounts are available in the physical store and not in drives and vice-versa.

⁵E.g. see Auchan website : <http://www.groupe-auchan.com/nos-activites/hypermarches/> or Neuville (2009). Notice that in France supermarkets and hypermarkets represent more than 70% of grocery sales (Anderton et al., 2011).

⁶A ‘price spell’ is the triplet made of the following three elements:

1) the price of a precisely defined product i , identified by its bar-code (e.g., a 1 liter glass bottle of brand b pure orange juice) in a given store j (e.g., the supermarket/drive from the retailing group g , located at a given address),

2) the date when this price was first set (start date of the price spell),

3) the date when this price was changed, possibly temporarily only (end date of the price spell).

If the price of a product in a shop decreases from 1 euro to 80 euro cents and then increases to 90 euro cents, this will define 3 price spells, possibly (right or left) censored.

⁷At the end of April 2012 we were provided with a first data base covering the period March 2010 to mid-April 2012. We then obtained in October 2012 a second data base that covers the period April

due to technical problems, the first waves of collected prices were often subject to severe measurement errors regarding in particular the beginning and end dates of the recorded price spells and/or the classification of products. Our analysis is then based on price data limited to the period from August 2011 until June 2012. Overall, this data set comprises about 52 millions spells starting in August 2011 or later, the original price records having most often been collected on a daily basis.⁸

Because our focus in this paper is on the soda tax, we restricted the sample to non-alcoholic beverages, and more specifically to three categories of products: (i) waters, (ii) fruit drinks and ready-to-drink teas, and (iii) sodas (including colas, energy, tonic and other soft drinks). A ‘product’ is a specific beverage defined by its brand, its physical characteristics (nature of the content, volume content, presence of added sugar or sweetener, etc) and its packaging (e.g., 1 liter of pure apple juice, in a glass bottle, produced by Pampryl). It is uniquely identified by its EAN barcode⁹. The original data set contains prices of about 3,000 distinct non-alcoholic beverage products and each drive on average sells 345 of these products (unfortunately not continuously).

Besides the necessary shortening of the period of analysis induced by the unreliability of the recorded start and end dates of price spells before August 2011, we had to do some further trimming of the data set. First of all, the information about the sugar or sweetener content of beverages was not easily accessible for all beverages. After discarding products for which we could not find this information, the ‘beverage sample’ contained more than 2 millions price spells associated with about 1700 distinct beverages. Second, we also discarded spells with inconsistent start and end dates (i.e., a start date posterior to the end date). Third, some more trimming had to be done due to missing data or outliers regarding the price or the quantity contents for some products. In order to limit the presence of outliers, we computed, for all products within classes defined by product category \times brand \times month \times soda tax liability, the distributions of the price per liter and discarded the observations below the 1st and above the 99th percentiles. Moreover, we excluded prices associated with monthly increases or decreases exceeding $\pm 30\%$, in

to September 2012. The availability of exact identifiers of both products and drive outlets allowed us to merge these two data bases.

⁸At the beginning of price collection in March 2010, Prixing collected prices in less drives and not necessarily daily. A preliminary analysis of the data bases suggested that data are reliable since August 2011. Starting the sample in May 2011, i.e., only three months before the current beginning date of the sample (August 2011), would dramatically decrease the number of price trajectories available in a balanced panel to 2,268 (instead of 51,622 in the current sample). Adding three months before and after the current sample, that is having a balanced panel from May 2011 to September 2012 would only leave 1,776 price trajectories. A balanced sample from November 2010 to September 2012 would contain no observation.

⁹The EAN barcodes (originally European Article Number, now renamed International Article Number even though the abbreviation EAN has been retained) are international product identification numbers.

log-differences.¹⁰ Fourth, to avoid composition effects and to allow for a proper difference in difference analysis, we kept in the sample only the combinations of products and shops for which the price was recorded every month over the period August 2011 to June 2012.

Since the total number of observations was still considerable (more than 15 millions price records, once price spells are converted into daily price records), we decided to keep only one price observation per month, chosen as the most frequently observed price over a month for each specific product sold in a specific shop. The resulting monthly modal price is similar in spirit to the reference price as defined in Eichenbaum et al. (2011),¹¹ that is a ‘normal’ price around which there may be temporary fluctuations (e.g., due to temporary promotions). Since we are not interested in the day to day impact of the tax on prices, ignoring temporary price discounts should not be an issue.¹²

Finally, in order to improve the representativeness of our sample, we have weighted the data. Indeed, besides the issue of the sample representativeness of brands, not all retailing groups developed drives at the same pace. In particular, one of the major retailing groups in France lagged behind regarding the opening of this type of outlet, while a smaller player offered this option in most of its supermarkets, even in small ones. Therefore, our sample of drives (although almost exhaustive) did not necessarily provide a representative picture of supermarket sales at the aggregate level. The weight given to each observation in our sample was defined in two steps. First, the weight ω_{bg} of brand b sold in retailing group g has been computed as the product of the brand market share MB_b (see Tables A2 to A4 in the Appendix) by the retailing group market share MG_g (see Table A1 in the Appendix):

$$\omega_{bg} = MB_b \times MG_g.$$

The same rule has been used for computing the market share of each retailing group’s private label: the total market share of private labels has been split across retailing groups, assuming that their respective market share is that of the retailing group itself.

Second, the weight ω_{bg} has been divided by the number of observations available for brand b in retailing group g , assuming that brand market shares are broadly similar across

¹⁰Using an higher threshold (+/- 80%) does not induce any significant change in the estimation results (available upon request).

¹¹In Eichenbaum et al. (2011), reference prices are defined as the modal price over a quarter, while we opt for the modal price over a month.

¹²Temporary discounts are not very frequent in our sample nor in the French retailing sector in general and are not seasonal (e.g. see Baudry et al., 2007, and Berardi et al., 2013), so that their impact, if any, should be negligible. Moreover, for these temporary sales to have a significant impact on the pass-through estimates would require a strong and permanent change in their frequency and magnitude, specifically for taxed products after the tax implementation, a phenomenon about which we have no indication.

shops of the same retailing group:

$$\omega_{bg}^* = \omega_{bg} / N_{bg}.$$

Therefore, the weighted sample should be representative, at the national level, of both the retailing groups' market shares and of those of brands.¹³

Table 1 reports some descriptive statistics about our final sample, decomposed into: waters that contain added sugar/sweetener (typically flavored waters), and those that don't; fruit drinks that contain added sugar/sweetener and fruit juices that don't; and sodas, which all contain either added sugar or sweetener.

Table 1: Descriptive statistics (August 2011 - June 2012 sample)

Product category:	Tax	N. obs. per month	N. of products	N. of shops	Mean price (euro/liter)		
					Aug.2011	Dec.2011	Jun.2012
Water	No	9806	166	747	0.55	0.55	0.54
	Yes	1292	25	504	0.78	0.78	0.83
Fruit drink	No	13705	271	722	1.70	1.72	1.74
	Yes	9515	157	635	1.19	1.19	1.25
Soda	Yes	17304	226	716	1.23	1.23	1.30
Total	-	51622	845	760	-	-	-

Despite the trimming that had to be done, our sample compares favorably in terms of number of observations, product coverage, and shop coverage to most of those used in the literature for assessing the impact of taxes on prices. Indeed, our econometric sample contains 567,842 observations made of 51,622 price trajectories regarding the prices of 845 products sold in at least one among the 760 drive outlets in which prices have been collected.¹⁴ The external validity of results based on our data is supported by the fact that drives have exactly the same prices as the physical store and a very similar range of

¹³The results obtained using the unweighted data (available upon request) are not qualitatively different from those presented below.

¹⁴In order to check the robustness of our results to the sample composition, we built a second econometric sample covering the period November 2011 to June 2012 (see Section 4.3). This restricted period allows to significantly increase the number of products for which we are able to continuously track prices (see Appendix B).

products, as well as by our weighting, which ensures representativeness at the national level of both brands and retailing groups' market shares.

Table 1 also shows that average prices are, not surprisingly, different across product categories. This is a direct consequence of their specific characteristics: pure fruit juices are higher quality products than fruit flavor beverages. Similarly, flavored waters are more sophisticated products than simple waters.

3 Empirical strategy for the assessment of the tax pass-through

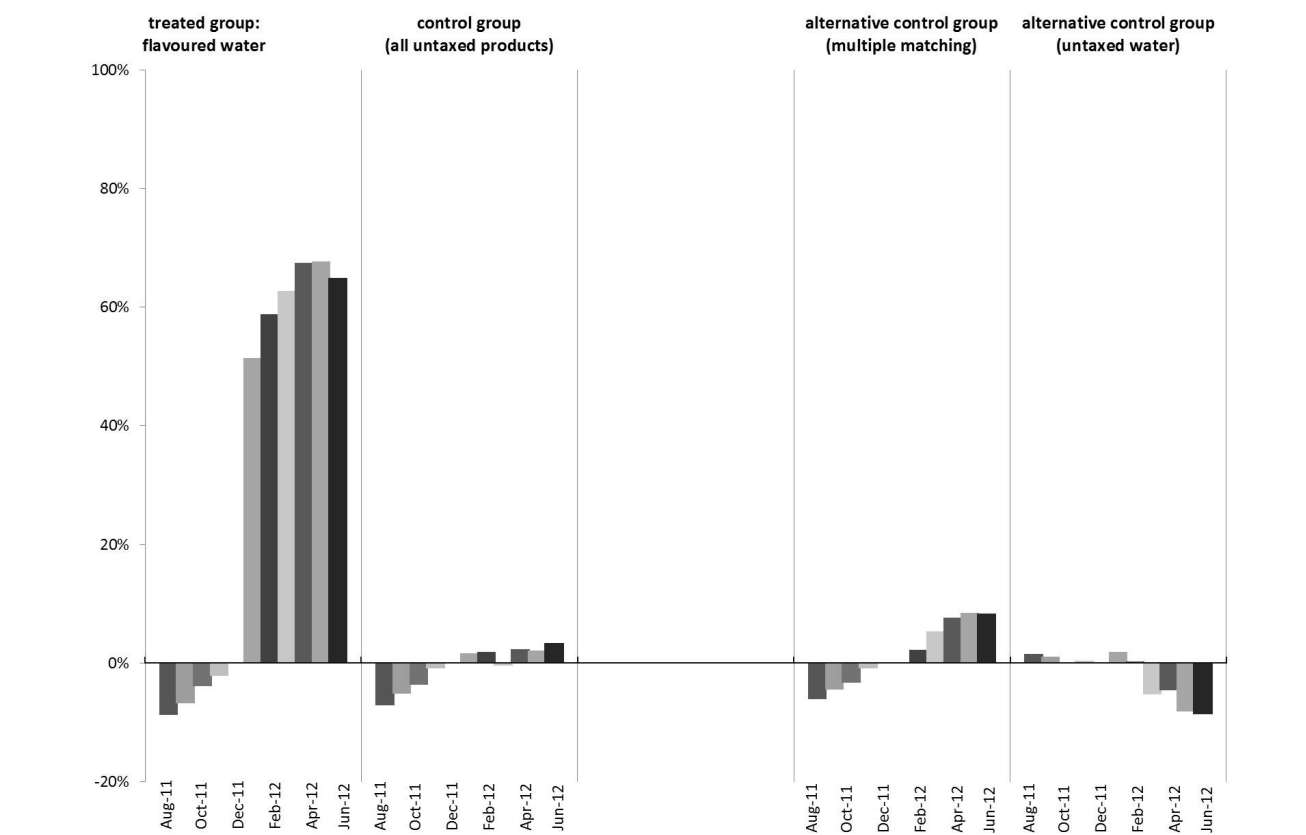
3.1 Definition of control groups

In order to estimate the pass-through of the soda tax, one would ideally compare the evolution of prices of the concerned products with their counterfactual price evolution had the excise not been introduced. Since it is impossible to observe the true counterfactual, the empirical strategy to identify the pass-through of the soda tax relies on the comparison of the treated individuals with those of a control group, which is assumed to reflect the behavior of the treated group if the treatment had been absent. Therefore, a prerequisite for a satisfactory control group is to exhibit a price evolution as similar as possible to that of the treated group before the treatment, that is before the introduction of the excise in January 2012.

Figures 1, 2, and 3 below represent (respectively for flavored waters, fruit drinks and teas, and sodas) the evolution of the average prices of the products that became liable to the tax in January 2012 (represented in the left graph in each Figure), together with those of prices for some alternative control groups (other graphs to the right in each Figure), month by month between August 2011 and June 2012. The monthly average price level is normalized to the average price in December 2011 (the month before the excise introduction) for taxed and untaxed beverages within each product category, so that each bar represents the difference between the average price during a given month and that of prices prevailing in December 2011. The observed price changes are represented in the graphs as percentages of the expected price change (including VAT) in case of full pass-through of the excise. For instance, 80% of full-pass-through corresponds to a nominal price increase of 6 cents.¹⁵

¹⁵80% of the excise tax including VAT (7.16 cents plus a 5.5% VAT), that is, 80% of 7.55 cents.

Figure 1: Evolution of average prices of taxed flavoured water and corresponding control groups, normalized to the price in December 2011 and expressed as percentages of the full pass-through



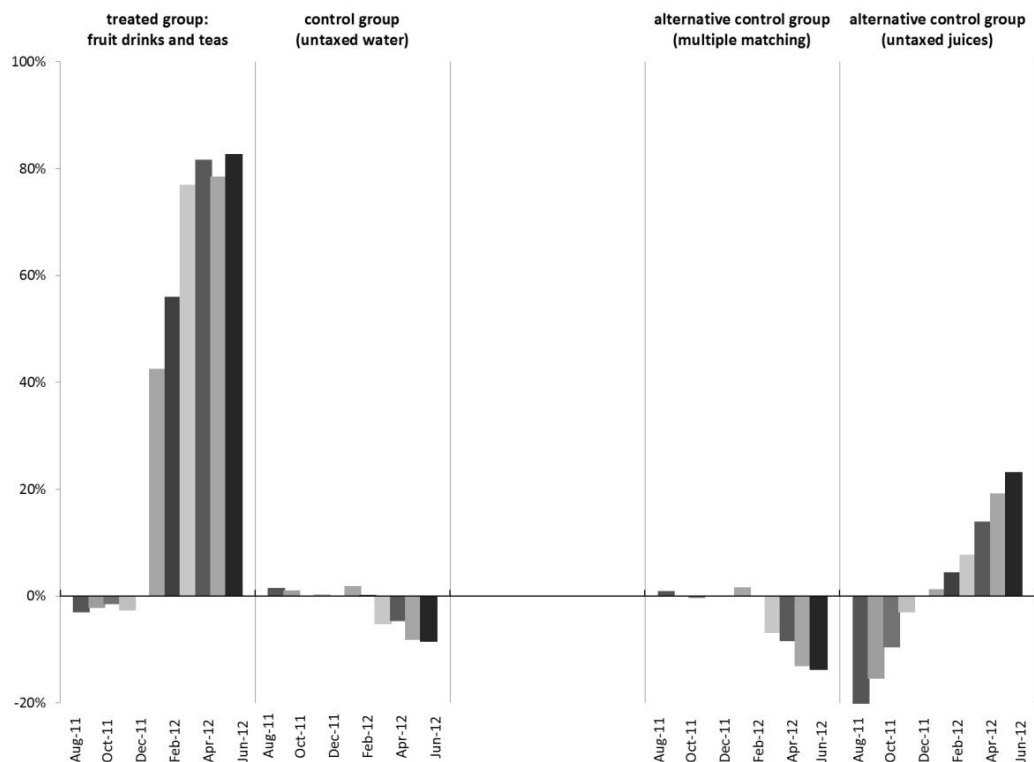
Note : The left panel shows the difference between the monthly average price of the taxed product category and its price in December 2011, as percentage of the full pass-through (7.55 cents, VAT included). The second panel shows the evolution of prices for the preferred control group. The last panels show the evolution of prices for alternative control groups.

The graphs on the left of Figures 2 and 3 show that, for fruit drinks and teas as well as for sodas, the average price trajectory of the products liable to the tax was remarkably flat before the introduction of the tax. Flavoured waters (Figure 1) do not exhibit the same pattern: their prices increased at a quite regular (yet quantitatively limited) pace during the pre-tax period. These graphs also show that prices of taxed beverages strongly increased from January 2012 onward, pointing to a quite significant and immediate impact of the tax.

Next to the right, the evolution of the average prices of products constituting our preferred control group is presented. The benchmark control group for flavoured waters is the whole set of beverages not affected by the excise, that is, water and fruit juices

without sugar or sweetener added. Indeed, the overall evolution of prices of these untaxed beverages before the tax introduction is quite close to that of the taxed flavored waters. For taxed fruit drinks and sodas, the evolution of prices before the introduction of the tax was quite flat, a characteristic shared by ‘normal’ waters, which therefore constitute their benchmark control group.

Figure 2: Evolution of average prices of taxed fruit drinks and teas and corresponding control groups, normalized to the price in December 2011 and expressed as percentages of the full pass-through

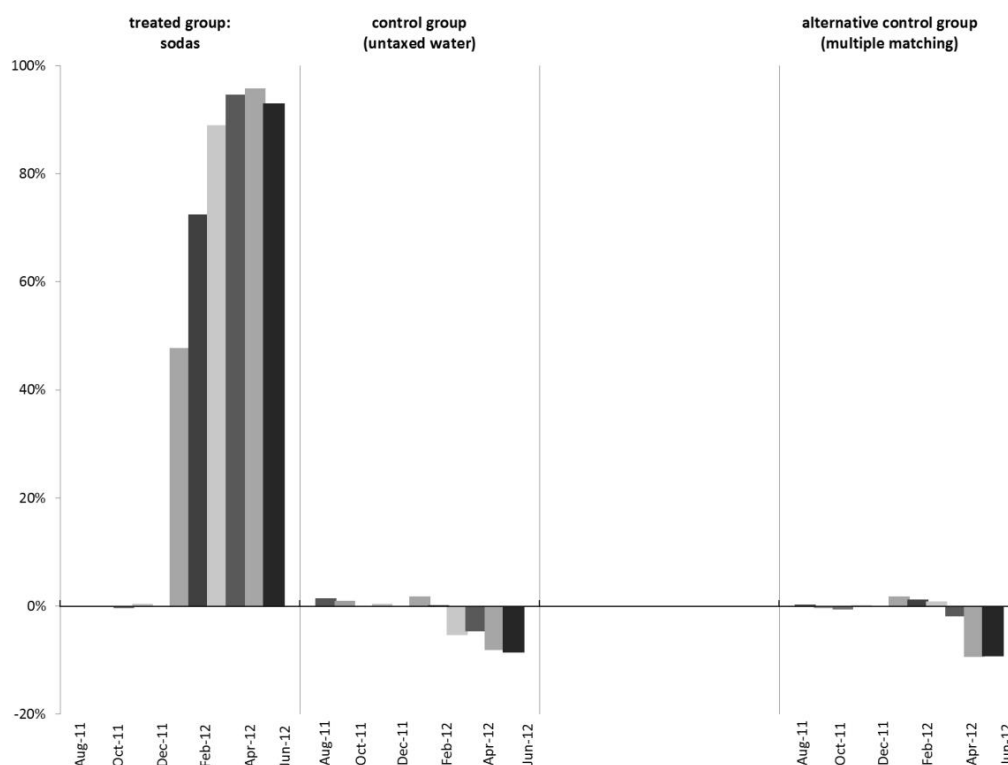


Note: The left panel shows the difference between the monthly average price of the taxed product category and its price in December 2011, as percentage of the full pass-through (7.55 cents, VAT included). The second panel shows the evolution of prices for the preferred control group. The last panels show the evolution of prices for alternative control groups.

Finally, the right panels of the Figures present alternative control groups, used for checking the robustness of our conclusions. The first set of alternative control groups have been obtained using a matching procedure: each taxed beverage sold in a given shop was matched with all untaxed beverages sold in the same shop, with weights proportional to the closeness of their pre-tax price evolution (see Section 3.2 for a more detailed presentation of this matching procedure). The last graphs shown in Figures 1 and 2 provide the price evolution for the last alternative control groups we consider. They

correspond to untaxed products of the same category (waters in Figure 1 and fruit drinks and juices in Figure 2). Such a control group does not exist for sodas as there exists no soda without added sugar or sweetener. This definition of the control groups relies on the supposed similarity of the physical characteristics of taxed and untaxed beverages within each category. However, these control groups do not strictly comply with the common trend assumption.

Figure 3: Evolution of average prices of sodas and corresponding control groups, normalized to the price in December 2011 and expressed as percentages of the full pass-through



Note: The left panel shows the difference between the monthly average price of the taxed product category and its price in December 2011, as percentage of the full pass-through (7.55 cents, VAT included). The second panel shows the evolution of prices for the preferred control group. The last panels show the evolution of prices for alternative control groups.

Before moving to the details of the econometric models and estimated results, notice that Figures 1, 2, and 3 clearly show at a descriptive level that all the alternative control groups lead to the same qualitative conclusion: the tax was under-shifted to prices of flavored water and fruit drinks and fully shifted to soda prices.

3.2 Econometric estimation of the pass-through

Figures 1, 2, and 3 graphically suggest that the implementation of the soda tax induced a significant increase in the prices of the beverages concerned by the excise. However, a proper quantitative assessment of the impact of the tax on prices calls for the use of treatment analysis tools. Our preferred estimates of pass-through for (taxed) flavored waters, fruit drinks, and sodas are obtained using a standard difference in differences approach, in which the control groups have been chosen so as to share similar pre-tax average evolutions of prices, by respectively estimating the following three econometric models:

$$\begin{aligned}
 P_{ijt} &= \sum_{\tau} \beta_{\tau}^w D_{ijt\tau} + \lambda_t^w + \alpha_i^w + \delta_j^w + \varepsilon_{ijt} \\
 &\text{with } i \in \{\text{taxed flavored waters, all untaxed beverages}\}, \\
 P_{ijt} &= \sum_{\tau} \beta_{\tau}^f D_{ijt\tau} + \lambda_t^f + \alpha_i^f + \delta_j^f + \varepsilon_{ijt} \\
 &\text{with } i \in \{\text{taxed fruit drinks, untaxed waters}\}, \\
 P_{ijt} &= \sum_{\tau} \beta_{\tau}^s D_{ijt\tau} + \lambda_t^s + \alpha_i^s + \delta_j^s + \varepsilon_{ijt} \\
 &\text{with } i \in \{\text{taxed sodas, untaxed waters}\}
 \end{aligned}$$

where P_{ijt} is the monthly modal price per liter (in euro cents) of product i sold in shop j at time t ; the dummy variable $D_{ijt\tau}$ equals 1 when product i contains added sugar or sweetener and the period $\tau \in \{Jan., Feb., Mar., Apr., May, Jun.\}$ (i.e., the product is liable to the tax), while it equals 0 otherwise. The parameters β_{τ}^c for $c \in \{w, f, s\}$ (for waters, fruits drinks, and sodas, respectively) measure the price increase (in euro cents per liter) induced by the tax. They have to be compared to 7.55, that is the price increase that would be associated with a full pass-through of the tax. The parameters λ_t^c , α_i^c and δ_j^c are fixed effects controlling respectively for the aggregate time effects, for product unobserved and observed time-invariant characteristics (including whether they contain added sugar or sweetener or not, whether the brand is a private label or a national brand, etc.) and for unobserved and observed time-invariant shop characteristics (retailing group, location, local competition, etc.).

In order to test the robustness of the results, three additional sets of pass-through estimates have been obtained, respectively based on: 1) a matching procedure; 2) the same difference in differences approach as above, but with different control groups; and 3) a simple difference approach.

Matching aims at achieving the maximal similarity between the treated and untreated observations. The matching procedure we have implemented is inspired by

the synthetic control approach proposed by Abadie et al. (2010). However, given the large number of potential controls, their optimizing procedure is unfeasible in our case. We thus adapt their approach and adopt a matching procedure in two steps. First, we consider as ‘neighbors’ of a taxed beverage i sold in a shop j all the untaxed beverages sold in the same shop. Second, these untaxed beverages are given weights inversely proportional to the distance between their pre-tax price variations and those of the considered taxed beverage. More precisely, the distance is defined as $\sum_{September}^{December} |(P_{ijt}^{Taxed} - P_{ijt-1}^{Taxed}) - (P_{ijt}^{Untaxed} - P_{ijt-1}^{Untaxed})|$, that is, the sum over the period from September to December of the absolute values of the difference between the pre-tax monthly price variations $(P_{ijt}^{Taxed} - P_{ijt-1}^{Taxed})$ of the considered taxed beverage and that of an untaxed beverage sold in the same shop $(P_{ijt}^{Untaxed} - P_{ijt-1}^{Untaxed})$. In case the price of the taxed product remained unchanged over the whole pre-tax period, only untaxed products with unchanged prices over the same period are considered as possible neighbors, and all the matching observations are then given the same weights.¹⁶ Finally, the synthetic control associated with a taxed product was computed as the weighted average of its neighbors. This procedure thus amounts to build synthetic controls that are close to the treated unit, since the products used as controls share similar pre-tax price trends and are sold in the same shop.

The second set of alternative pass-through estimates corresponds to a simple and intuitive, though not necessarily statistically optimal, control group. Indeed, we simply take as the control group for taxed products of a category (waters, fruits drinks and teas) the group of all untaxed product in the same category: untaxed waters are used as the control group for taxed flavored waters, while untaxed fruit drinks and juices for taxed fruit drinks. This definition of the control groups essentially relies on the proximity of the main physical characteristics of the taxed and untaxed products. However, it does not guarantee that the parallel pre-trend assumption is satisfied.

The third set of alternative pass-through estimates is based on a simple difference analysis. Indeed, Figures 2 and 3 show that, at least on average, the prices of both taxed fruit drinks and sodas remained quite stable between August and December 2011. Therefore, it does not seem unreasonable, at least for these two product categories, to consider that simply comparing their prices before and after the tax (i.e., before and after January 2012) may provide a relatively satisfactory estimate of the pass-through.

¹⁶Notice that this procedure did not allow to find any match for a few taxed products sold in a given shop. We thus discarded these observations from our estimation sample for all the analyses. A comparison with the estimates obtained with our initial sample (see Berardi et al., 2012) shows that this did not have any significant implication for our pass-through estimates.

4 Average magnitude and timing of the pass-through of the soda tax to prices

Have producers and retailers passed the soda tax through to consumer prices? When and to which extent (a full pass-through of the soda tax would amount to 7.55 cents per liter)? This section answers these questions. We first present the difference-in-difference estimated pass-through of the soda tax over time resulting from our preferred control groups. The pass-through estimated with alternative control groups and other robustness checks follow.

4.1 Benchmark results

The left panel of Table 2 reports the estimated average impact of the tax on prices of products that are liable to the tax for each of the three product categories we consider (flavored water, fruit drinks and teas, and sodas).¹⁷ Since there may be lags in the transmission of the tax to prices, we report the estimated pass-through month by month over the first semester of 2012. The right panel shows the results of tests of the extent of the pass-through as of June 2012.

In contrast with the few results available in the literature about the impact of SSB taxes on prices, we do not get any indication of a significant over-shifting of the tax, on average. Indeed, we get only full pass-through of the tax in the case of sodas and an almost full pass-through for fruit drinks. More precisely, the average increase in prices for sodas reached the expected 7.55 euro cents in April 2012 and, even though soda prices still increased a bit after April 2012, in June 2012 the test cannot reject the assumption of a full shifting (while that of a significant over-shifting can be rejected at the usual 5% level). Regarding fruit drinks, the estimated pass-through (7.1 cents) is below the full pass-through threshold, thus leading to a slight under-shifting of the tax (with a pass-through coefficient of 94%). However, both the assumption of full shifting and that of under-shifting cannot be rejected (the p-value obtained when testing full shifting is larger than that obtained when testing for under-shifting). Finally, the pass-through of flavored waters is clearly incomplete. In June 2012 it amounted to only about 4.7 cents (62% of the full pass-through).

¹⁷Because the main objects of interest of this paper are the coefficients β_{τ}^c , which estimate the price effect of the tax, the Tables do not report the other parameter estimates. The full estimation results are available on request.

Table 2 : Average pass-through (in cents per liter) by month
(August 2011 - June 2012 sample)

Product category:	Pass-through estimates (Jan. to Jun.)						Pass-through degree tests (Jun.)		
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Under-sh.	Full shift.	Over-sh.
Water	3.8 (0.2)	4.4 (0.3)	4.8 (0.3)	5.0 (0.3)	5.0 (0.3)	4.7 (0.3)	-7.42 (1.00)	10.12 (0.00)	-12.81 (0.00)
Fruit drink	3.3 (0.6)	4.4 (0.6)	6.4 (0.4)	6.7 (0.7)	6.7 (0.7)	7.1 (0.7)	0.41 (0.34)	0.67 (0.50)	-1.75 (0.04)
Soda	3.5 (0.5)	5.5 (0.6)	7.2 (0.4)	7.5 (0.5)	7.9 (0.4)	7.7 (0.3)	2.72 (0.00)	0.47 (0.64)	-1.78 (0.04)

Note: all regressions contain month, shop and product fixed effects.

Left panel: Standard errors, clustered by shop, are given in parentheses.

Right panel: T-stat with p-value in parentheses, where:

under-shifting corresponds to H_0 : pass-through $\leq 0.9 \times 7.55$ cents per liter;

full shifting corresponds to H_0 : pass-through = 7.55 cents per liter;

over-shifting corresponds to H_0 : pass-through $\geq 1.1 \times 7.55$ cents per liter.

Our estimates are significantly lower than those obtained by Bergman and Hansen (2013) who get an estimated impact of excise tax changes in Denmark always above 200%. The magnitude of our pass-through estimates is also lower than those recently provided by Bonnet and Réquillart (2013) on French data with a more structural approach. According to their results, an excise tax on sodas would be over-shifted to prices, with pass-through coefficients ranging between 107% and 140%, depending on the brand. One explanation of the discrepancy between our results and theirs is that the latter rely on a model assuming that producers have more power than retailers when negotiating producer/wholesale prices and are able to use resale price maintenance. Section 5 illustrates a simple model that allows the opposite possibility (i.e., that retailers can be more powerful than producers) and leads to predictions that are consistent with our estimates. This may be more appropriate in France, as suggested by some evidence. First, the official definition of ‘unfair terms’ (‘déséquilibre significatif’ in French) regarding the regulation of negotiations between producers and retailers mainly lists examples of abuses by large retailers (like excessive penalties imposed by retailers on producers, excessive terms regarding price renegotiation for the benefit of the retailer, etc.).¹⁸ Second, if implemented as assumed by Bonnet and Réquillart (2013), the retailing price maintenance should limit

¹⁸see http://www.economie.gouv.fr/files/directions_services/dgcrf/documentation/fiches_pratiques/fiches/Desequilibre_significatif1206.pdf

the differences in the prices of the concerned products, at least across stores belonging to the same retailing group. However, empirical evidence suggests the opposite, even for large, well-known, dominant producers (Dauvers, 2014). Our data also show price differences that often exceed 30% for the same product across stores belonging to the same retailing group.

The absence of over-shifting that is pointed out by our results is not surprising, based on the fact that the elasticity of demand for non-alcoholic beverages consumption to prices has been estimated to be significantly larger than 1, in absolute value (e.g., Bonnet and Réquillart, 2013 and Bonnet and Dubois, 2010 on French data, as well as Pofahl et al., 2005 or Alviola et al., 2010 on US data). Moreover, these studies also show that the price elasticity of demand for water is larger (in absolute value) than that for the two other groups of products (which instead have similar price elasticities). Indeed, Bonnet and Réquillart (2013) estimate that demand elasticities for sodas and fruit drinks range from -2.13 to -3.95 (depending on the brand), while Bonnet and Dubois (2010), using similar data (the TNS/Kantar Worldpanels for 2005 and 2006 in France) and approach (a random coefficients logit model), estimate that the elasticity of water demand is -5.8. This provides a rationale to the differences in the estimated pass-through between water, on the one hand, and fruit drinks and sodas on the other hand. Moreover, the lower pass-through obtained for water may also stem from the fact that flavored waters are more easily substituted by other products than fruit drinks and sodas. Indeed, normal waters are similar and cheaper than (taxed) flavored waters. This contrasts with the case of fruit drinks: pure fruit juices are significantly more expensive than fruit drinks, thus making the substitution more unlikely. In the case of sodas, finding a close (and untaxed) substitute is even more difficult, as all sodas are liable to the tax and as the degree of product differentiation is quite high across sodas.

Beyond the issue of the magnitude of the pass-through, it is also interesting to notice that the pass-through of the tax to beverage prices was spread over several months. Despite the fact that a significant number of retailers left their prices unchanged in January, i.e., even after the tax became effective (see Berardi et al., 2012),¹⁹ between one half (for fruit drinks) and two-thirds (for sodas) of the tax was, on average, already passed-through to the prices in January. This is not imputable to a simple January seasonal effect, since the evolutions of the official price indices for waters on the one hand, and fruit drinks and sodas on the other hand, do not exhibit any seasonal pattern (see Figure C1 in the Appendix). Finally, the stabilization of the pass-through estimates for waters and soda (and to a lower extent for fruit drinks) from May 2012 onward can be

¹⁹This phenomenon was also emphasized by Bergman and Hansen (2013) regarding the impact of the Danish SSB taxes.

considered an indication that all the desired price adjustments associated with the SSB tax were completed by the end of the first semester 2012.

4.2 Alternative control groups and simple differences

In order to assess the robustness of the estimates provided in the previous section, we estimated the tax pass-through using the alternative control groups described in Section 3. The estimated average pass-through coefficients (as of June 2012) resulting from these alternative control groups are reported in Table 3.

First, considering the synthetic control groups obtained by our matching procedure, the comparison between the second and the third columns of Table 3 indicates that this computationally very intensive procedure leads to estimated pass-through that are extremely similar to our benchmark.

The fourth column of Table 3 shows the estimated pass-through when considering the second set of alternative control groups, i.e., untaxed waters and untaxed fruit juices as alternative control groups for flavored waters and fruit drinks respectively. Although these results still point to an under-shifting of the tax for flavored waters and fruit drinks, from a quantitative point of view the pass-through appears larger for flavored waters and smaller for fruit drinks with respect to our benchmark estimation. This is due to the fact that, even though the treated and control groups share a similar nature, the latter do not comply with the common trend assumption. On the one hand, the larger pass-through for flavored waters comes from the stability of normal water prices before January 2012, which doesn't perfectly match the slightly increasing prices of the former. On the other hand, the lower pass-through for fruit juices results from the fact the average price of pure fruit juices exhibit an increasing pre-tax trend.²⁰

Finally, the last column of Table 3 shows the estimated pass-through coefficients relying on simple differences, i.e., the impact of the pass-through is estimated only based on the differences in the prices of the products that are liable to the tax before and after the tax was implemented. The results again point to an under-shifting of the tax and to the same ranking of the pass-through across product categories as our benchmark results: the pass-through was larger for sodas than for fruit drinks, while in turn fruit drinks exhibited a larger pass-through than flavored waters.

²⁰Moreover, although pure fruit juices seem at first an intuitive control group for fruit drinks in terms of the product nature, they have a composition (100% fruit juice) that strongly differs from that of fruit drinks and ready-to-drink teas (for which the main ingredient is water).

Table 3 : Average pass-through (in cents per liter) in June 2012 for alternative control groups and first difference (August 2011 - June 2012 sample)

Treated group Product category:	Preferred control gr.	Alternative (Matching)	Alternative (Untaxed prod. of same prod. categ.)	First diff.
Water	4.7 (0.3)	4.7 (0.2)	5.9 (0.5)	4.9 (0.2)
Fruit drink	7.1 (0.7)	6.8 (0.4)	3.9 (0.4)	6.3 (0.3)
Soda	7.7 (0.3)	7.5 (0.4)	-	7.0 (0.2)

Note: all regressions contain month, shop and product fixed effects.

Standard errors, clustered by shop, are given in parentheses.

4.3 Further robustness checks

Beyond defining control groups in alternative ways, we also tested for the reliability of the benchmark estimates running two other types of robustness checks. First, we estimated an alternative model allowing the price of products liable to the tax to increase from October 2011, i.e., when the excise was discussed in the Parliament.²¹ Indeed, it is possible that producers and/or retailers anticipated their reaction to the excise and started raising their prices before January 2012. In order to check whether this might have been the case, we estimated a model allowing retailers to have increased prices of the products containing sugar or a sweetener starting from October 2011 (i.e., even before these products were actually taxed). The results are reported in Table 4 and point to the absence of an anticipation behavior.

Second, we further checked the robustness of our results by estimating our benchmark model on a different sample, which starts in November 2011 rather than in August 2011. The rationale for this choice is that the evolution of prices between August and December 2011 was rather flat. Therefore, using as pre-tax prices even only a couple of months before the tax (November and December 2011) should not make a big difference with respect to using pre-tax prices observed over the five months between August and December 2011. However, the great advantage of starting our sample in November 2011 is a huge increase in the product coverage. Indeed, the number of products continuously

²¹It was definitively voted in December 2011, just a few days before its implementation.

observed between November 2011 and June 2012 is much larger than that of products observed between August 2011 and June 2012. This alternative ‘November to June’ sample contains prices of 1,019 products sold in 958 shops, amounting in total to 1,056,416 observations (versus 845 products sold in 760 shops, amounting to 567,842 observations in our ‘August to June’ sample). As the estimates in Table 5 show, the pass-through coefficients obtained with this larger sample are qualitatively similar to those obtained with the sample covering the longer period. The main difference is that the conclusion that the French soda tax was not fully passed-through to prices extends here to sodas.

Table 4 : Average pass-through (in cents per liter) by month, allowing for anticipated price increases (August 2011 - June 2012 sample)

Product category:	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.
Water	0.1 (0.1)	0.0 (0.1)	0.1 (0.2)	3.9 (0.2)	4.4 (0.3)	4.9 (0.3)	5.0 (0.3)	5.1 (0.3)	4.8 (0.3)
Fruit drink	0.2 (0.2)	0.1 (0.2)	0.3 (0.2)	3.4 (0.5)	4.5 (0.6)	6.5 (0.5)	6.8 (0.8)	6.8 (0.8)	7.2 (0.8)
Soda	0.1 (0.1)	0.1 (0.1)	0.1 (0.1)	3.6 (0.5)	5.5 (0.6)	7.2 (0.4)	7.6 (0.5)	7.9 (0.5)	7.8 (0.4)

Note: all regressions contain month, shop and product fixed effects.

Standard errors, clustered by shop, are given in parentheses.

Table 5 : Average pass-through (in cents per liter) by month, based on a larger sample referring to a shorter period

(November 2011 - June 2012 sample)

Product category:	January	February	March	April	May	June
Water	3.0 (0.2)	4.4 (0.2)	4.8 (0.2)	5.3 (0.1)	5.2 (0.1)	5.1 (0.1)
Fruit drink	3.2 (0.2)	4.9 (0.2)	5.9 (0.2)	6.4 (0.1)	6.6 (0.1)	6.8 (0.1)
Soda	2.9 (0.2)	4.9 (0.3)	6.2 (0.2)	6.7 (0.1)	7.0 (0.1)	6.9 (0.1)

Note: all regressions contain month, shop and product fixed effects.

Standard errors, clustered by shop, are given in parentheses.

5 Heterogeneity in the pass-through of the soda tax to prices

There are many reasons that may cause a heterogeneous pass-through of a tax, for instance across geographical areas or other dimensions, as emphasized in Harding et al. (2012). As far as SSB taxes are concerned, competitive relationships among producers on the one hand, among retailers on the other hand, as well as between producers and retailers crucially affect the tax pass-through in non-alcoholic beverage markets (Bonnet and Réquillart, 2011, 2013). Two features of the retail trade sector and of the beverage production sector seem to benefit from a large consensus. First, these markets are not perfectly competitive. Second, they provide more or less strongly differentiated goods (Gasmi et al., 1992; Cotterill et al., 1996; Dube, 2005). Unfortunately, characterizing more precisely the nature of competition that prevails on these two markets is less obvious. Competition between retailers has several dimensions: a local one, associated with the competition prevailing between outlets and their local competitors; but also a global one, stemming from the overall size of their group and their capacity to negotiate with producers through their buying groups (Bonnet and Réquillart, 2013; Bonnet and Dubois, 2010). The nature of these vertical relationships also clearly depends on the relative size of the retailer and the producer. The heterogeneity of competitive situations is then likely to induce the same diversity regarding the way retailers and producers of beverages shifted the SSB tax to their prices. We have then estimated a model where the pass-through is allowed to vary simultaneously across brands and retailing groups:

$$P_{ijt} = \sum_{\tau} \sum_{b \times g} \beta_{\tau, b \times g}^c \times D_{ijt\tau} \times D_{ijt\tau}^b \times D_{ijt\tau}^g + \lambda_t^c + \alpha_i^c + \delta_j^c + \varepsilon_{ijt}$$

where $D_{ijt\tau}$, λ_t^c , α_i^c , and δ_j^c are defined as above with $\tau \in \{Jan., Feb., Mar., Apr., May, Jun.\}$ and $c \in \{w, f, s\}$; $D_{ijt\tau}^b = 1$ if product i is produced and sold under brand b , $D_{ijt\tau}^b = 0$ otherwise; $D_{ijt\tau}^g = 1$ if shop j belongs to retailing group g , $D_{ijt\tau}^g = 0$ otherwise. The pass-through parameters $\beta_{\tau, b \times g}^c$ are then specific to each combination of brand and retailing group. We considered the 6 retailing groups present in our data set (see Table A1 in the Appendix) and all product brands for which we know the market share (see Tables A2 to A4 in the Appendix).²²

²²The products corresponding to the remaining brands were grouped together within an ‘Others’ brand/category sharing the same pass-through.

Figure 4: Distributions of brand and retailing group specific pass-through estimates, by product category.

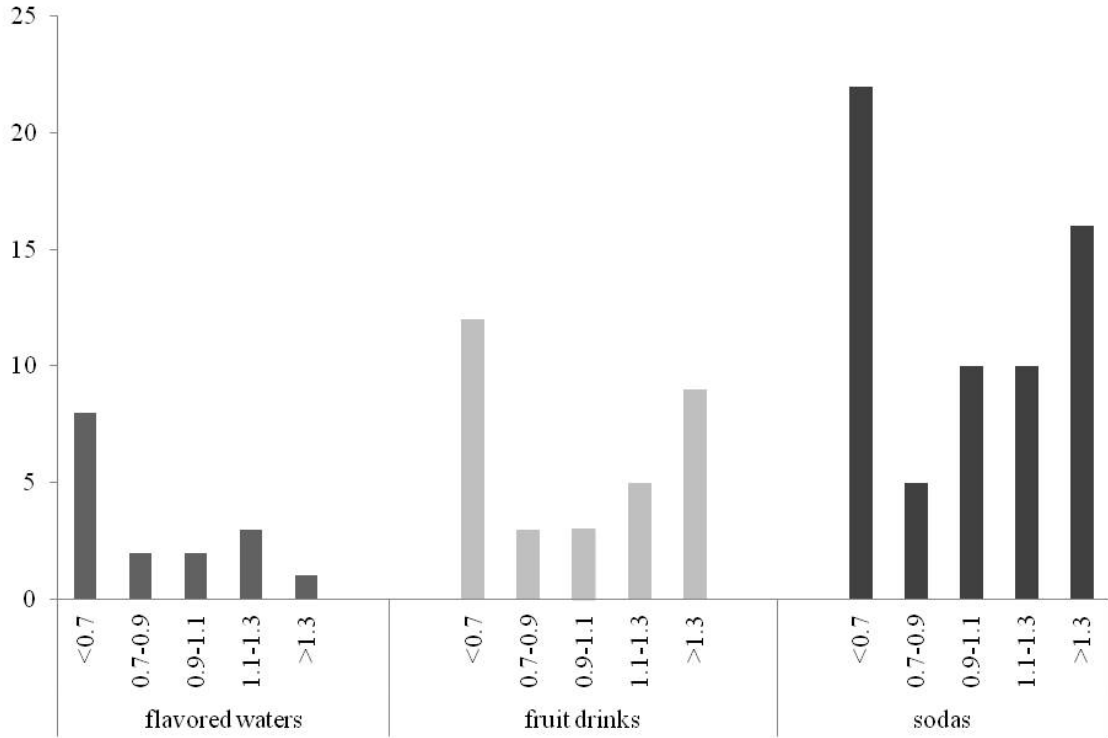


Figure 4 provides the distribution of the 111 available estimates $\hat{\beta}_{\tau, b \times g}^c$, (16 for flavored waters, 32 for fruit drinks and 63 for sodas) and points to a quite strong heterogeneity across the pass-through estimated coefficients. Both low pass-through (i.e., below 0.7) and high pass-through (i.e., above 1.3) are very common and these differences are statistically significant. The assumptions of a common pass-through either across brands or across retailing groups are both strongly rejected by a formal F-test. We also ran tests of a significant under-shifting and of a significant over-shifting of the tax for each of the 111 combinations of product brands and retailing groups. In 43 cases (out of 111), the assumption of under-shifting (i.e., a pass-through below 0.9) is accepted, while the alternative assumptions of a full shifting (i.e., pass-through=1) and that of over-shifting (i.e., pass-through above 1.1) are both rejected (at the 5% significance level). Similarly, in 39 cases out of 111, the assumption of over-shifting is accepted, while the two others hypotheses (full shifting and under-shifting) are both rejected. Only in a few cases, we could accept the assumption of full shifting alone. In the remaining cases at least two of the assumptions could not be rejected.

It seems reasonable that the extent of the pass-through is not specific to the retailing group or to the brand, but rather to their interaction.²³ In order to check for this intu-

²³We tried to link the heterogeneity in different ways with the market shares of the brands and retailers,

ition, we estimated a somewhat simpler model where we consider two types of retailers (the ‘Leaders’ and the ‘Other retailers’) as well as three kinds of brands/producers (‘Private labels’, ‘Large producer brands’ and ‘Small producer brands’). Concerning retailers, we put together the two main groups of the retailing industry in France (Carrefour and Leclerc) in ‘Retailing leaders’ and the another groups in ‘Other retailers’. Regarding brands, the classification of brands other than private labels into ‘Large producer brands’ or ‘Small producer brands’ is done in the following way. For the three categories of products (waters, fruit drinks, sodas), we first identify the producer(s) of the two brands with the largest market shares and then consider all brands produced by these manufacturers as ‘Large producer brands’. Remaining brands are classified as ‘Small producer brands’. The ‘Large producer brands’ are brands belonging to Danone and Nestlé Waters for waters, to Pepsico-Unilever and Orangina-Schweppes for fruit drinks, and to Coca-Cola and Orangina-Schweppes for sodas. The aim is twofold: first, brands of the same manufacturing group are considered together to allow for the possibility that these manufacturing groups do not price their brands independently, but rather have a global pricing policy; second, the distinction between ‘Retailing leaders’ and ‘Others retailers’ accounts for their respective bargaining power regarding prices at which producers deliver their products to retailers. The estimation results are provided in Table 6.

Table 6 : Average pass-through in cents per liter in June 2012
by type of brand and retailer size (August 2011 - June 2012 sample)

Product category:	Retailers:	Brands:		
		Private label brands	Large producer brands	Small producer brands
Water	Retailing leaders	8.4 (1.7)	1.2 (0.4)	-
	Other retailers	5.9 (0.3)	5.1 (0.4)	-
Fruit drink	Retailing leaders	10.1 (0.7)	4.2 (1.3)	7.2 (1.1)
	Other retailers	9.1 (0.5)	6.0 (0.3)	9.0 (0.6)
Soda	Retailing leaders	7.1 (0.8)	6.1 (0.6)	-1.9 (1.9)
	Other retailers	10.3 (0.5)	9.4 (0.4)	6.1 (0.7)

Note: all regressions contain month, shop and product fixed effects.

Standard errors, clustered by shop, are given in parentheses.

How can we rationalize these results given what we know about the beverage market but could not find any significant relationship.

ket and the producers-retailers relationships in France? First, French retailers strongly compete in price. Second, by law in France, processed food producers and retailers must negotiate once a year on sales conditions.²⁴ The negotiation basically sets a price list for different levels of quantities sold by the producer to the retailer, as well as possible rebates and discounts. The price agreement can be renegotiated in case a major and unforeseen event affects producers' production costs (including changes in taxes, such as a SSB tax).

Given the strong competition prevailing between retailers, one may consider that, when bargaining with producers, retailers already have a quite precise expectation, $E(P_c)$, about the price at which they expect to sell the product, given what they know about their competitors' prices as well as about the elasticity of consumers' demand. In the case of a product for which there is no stricto sensu direct competition with other retailers (e.g., for private label products), one may consider that the expected price is essentially determined by what retailers know about the elasticity of demand.

Let us assume that the bargaining between producers and retailers can be modelled as a Nash-bargaining game:

$$\underset{P_p}{Max} [(P_p - Cm_p)' \varphi(X) - \pi_p^0]^\theta [(E(P_c) - P_p)' \varphi(X) - \pi_c^0]^{1-\theta}$$

where:

- P_p is the vector of the producer price list, i.e., the list of prices associated with the different possible levels of quantities purchased by the retailer;²⁵

- Cm_p is the vector of the producer marginal cost, which may vary depending on the level of quantity possibly purchased by the retailer, X , determining that of the production level;

- $\varphi(X)$ is the vector of the different levels of quantities possibly purchased by the retailer, X , weighted by their probability of realization, assumed to be common knowledge for both the producer and the retailer. When the negotiation takes place, these quantities are just hypothetical purchased quantities. Indeed, the result of the negotiation is only an agreement about a price list. Retailers have no obligation regarding the volume they buy from the producer and they can decide to stop selling a product whenever they wish

²⁴The negotiation about sales conditions in year t usually start at the end of year $t - 1$, but have to be completed by the beginning of March of year t . New conditions cannot apply retrospectively to the period before the agreement has been reached.

²⁵For the sake of simplicity, we assume that the producer price makes most of the retailers' marginal cost. Including another component in the retailers' marginal cost would not change the main messages of the model, nor the interpretation of our results.

so;²⁶

- π_p^0 is the producer profit in case there is no agreement (we shall assume that in this case the product is not sold by the retailer, so that $\pi_p^0 = 0$);

- $E(P_c)$ is the expected retail price, anticipated by the retailer based on its knowledge of consumers' demand characteristics and competition;

- π_c^0 is the retailer profit in case there is no agreement (we shall assume that in this case the product is not sold, so that $\pi_c^0 = 0$);

- θ is the bargaining power of the producer and $(1 - \theta)$ that of the retailer. The bargaining power depends on the relative weight of the producer and the retailer on the market as well as on the elasticity of substitution between the product under negotiation and its substitutes (if any).

Participation constraints simply write as: $P_p \geq Cm_p$ for the producer and $P_p \leq P_c$ for the retailer. It is easy to show that, given these two participation constraints, the solution of this simple bargaining game is $P_p = E(P_c)^\theta \times Cm_p^{(1-\theta)}$ or in logarithms:

$$\ln(P_p) = \theta \ln(E(P_c)) + (1 - \theta) \ln(Cm_p).$$

If $\theta = 1$, the producer has the whole bargaining power and $P_p = P_c$. In other words, the margin goes entirely to the producer, while the retailer's margin is zero. If on the contrary $\theta = 0$, then $P_p = Cm_p$, so that the the producer makes no margin. In a second step, the retailer sets the consumer price of the product by (possibly) adding a margin to the producer price :

$$\ln(P_c) = \ln(P_p) + (1 - \theta) \ln(M).$$

This model then simply states that $\ln(P_c) = \ln(Cm_p) + \ln(M)$ and that the total margin M is shared between producers and retailers according to their bargaining power. The total margin depends on the market conditions both at the retail level (elasticity of consumers' demand, competition with other retailers, etc.) and at the production level (production costs, market power of the producer, etc.). In particular, the larger the elasticity of demand and the stronger the competition, the lower the margin.

In this framework, assuming a constant production marginal cost, the French excise tax corresponds to a 7.55 euro cents increase in the producers marginal cost. Producers with no bargaining power ($\theta = 0$) have a zero margin. Their participation constraint thus implies that they must fully shift the tax to the production price. Then, retailers may, depending on the market conditions at the retailing level, either fully shift the tax or absorb part of it in their margin. Depending on the market conditions, the tax may

²⁶E.g. see <http://www.lsa-conso.fr/les-produits-danone-sont-de-retour-chez-leclerc,128432> and <http://www.lsa-conso.fr/des-produits-laitiers-nestle-lactalis-absents-des-rayons-d-auchan,128583>.

thus be over-shifted (low elasticity of demand, low competition), or under-shifted (high elasticity of demand, strong competition). When producers have a strong bargaining power ($\theta = 1$), the extent to which they can pass the tax through to prices indirectly depends on the market conditions for their product at the retailing level. The tougher the competition, the lower the margin and, consequently, the extent of the pass-through of the tax to prices.

Are predictions drawn from this simple model consistent with our empirical findings? Concerning the heterogeneity of pass-through across brands, we find that, whatever the product category (waters, fruit drinks, sodas) and whatever the size of the retailing group, the pass-through of the tax was higher for private labels than for other brand products (see Table 6). This finding is consistent with our theoretical framework, since private labels are characterized by weaker bargaining power of producers²⁷ and smaller demand elasticity than other products²⁸. Moreover, as mentioned in Section 5.1, differences in the pass-through across product categories are consistent with the fact that the magnitude of the demand elasticity is lower for water than for the other two product categories. Contrary to the case of private labels, the pass-through coefficients estimated for ‘Large producer brands’ reveal an under-shifting of the tax to prices in almost all cases. This is consistent with the theoretical predictions of our model when large producers enjoy some bargaining power in the negotiations with retailers. Indeed, if producers benefit from price-cost margins, they have the possibility of not fully shifting the tax to their prices.²⁹ Moreover, if retailers harshly compete in price and the demand is rather elastic to the price, the tax is under-shifted to consumer prices, too. Concerning ‘Small producer brands’, we find that the estimated pass-through coefficients are larger than those of ‘Large producer brands’ in the case of fruit drinks. This is consistent with our simple bargaining framework, since it seems reasonable that the former have lower margins and can thus hardly afford not to shift the tax to their price. In the case of sodas the pass-through is not larger for small than for large producers, probably due to the characteristics of energy drinks.³⁰

²⁷Indeed, Bonnet and Réquillart (2011) and Bonnet and Dubois (2010) have shown that, for soft drinks and waters in France, the price-cost margin is lower for private labels than for other brands, which suggests low bargaining power of the producers of private label products. Bonnet and Réquillart (2013) and Bergès-Sennou et al. (2004) argue that the producers of private label products sell at production marginal cost.

²⁸Bonnet and Réquillart (2013) show that the demand elasticity for private label beverages, though significant, is smaller than that for other brands (between -2.13 and -3.65 for private labels, compared to -3.25 to -3.95 for other brands). The lower elasticity of the demand for private label products may also explain why we find that retailers over-shifted the tax to the prices of these products in most cases.

²⁹The beverage sector in France indeed enjoys large markups with respect to the food industry (see <https://www.banque-france.fr/economie-et-statistiques/entreprises/structure-et-performances-des-entreprises/fascicules-dindicteurs-sectoriels.html>).

³⁰As far as sodas of small producers are concerned, the estimates are strongly affected by the specific

Concerning the heterogeneity of pass-through across retailing groups, in most cases the tax pass-through is lower for the two largest retailing groups (the ‘Retailing leaders’) than for the other retailing groups. This is probably explained by the fierce price competition between these two large retailing groups, each of which regularly claim to be the cheapest one.³¹ Another complementary explanation, consistent with our model, is that the largest retailers were able to impose an under-shifting of the tax on producer prices, while smaller retailers were not in such a favorable bargaining position. Finally, notice once again that across product categories the pass-through of the tax was lower for waters, consistently with the higher price elasticity of demand for this beverage.

Overall, our estimation results are consistent with the prediction of a quite simple model in which the consumer price depends on the production costs as well as on the characteristics of demand (elasticity) and on those of the market (competition). The margin, defined as the difference between the retail price and the production cost, is then shared between producers and retailers on the basis of their respective bargaining power.

6 Conclusion

Our results show a significant under-shifting of the tax to prices of flavored waters, as well as a slight one to prices of fruit drinks. However, the full pass-through obtained for sodas together with the large share of these products (75%) in the total supermarket sales of non-alcoholic beverages liable to the tax (about 2.5 billion euros in 2011) suggests a quasi-full shifting of the excise to beverage prices at the macroeconomic level. Therefore, in contrast with the few available results on the effect of SBB taxes on prices (Bonnet and Réquillart, 2013 and Bergman and Hansen, 2013), our empirical analyses overall provide support for the full shifting assumption that is often made in studies about the impact of SSB taxes on the consumption of soft drinks, either explicitly (Dharmasena and Capps, 2012 and Brownell et al., 2009), or more or less implicitly by assuming a price increase stemming from an unspecified magnitude tax change (Smith et al., 2010; Finkelstein et

evolution of prices of a well-known brand of energy drinks exhibiting large price decreases in 2012. When this particular brand is excluded from the sample, the ‘Small producer brands’ pass-through raises from -1.9 to 5.0 for ‘Leading retailers’ and from 6.1 to 6.8 for ‘Other retailers’. Moreover, the average price of sodas of ‘Small producer brands’ is quite significantly higher than that of private labels and other brands. In particular, these products include most of the energizing drinks in our sample, which seem to enjoy high price-cost margins. This is likely to be due to the strong product differentiation existing in this segment of the beverage market. Indeed, not only the average prices of these particular soft-drinks are much higher than that of other beverages, but their standard deviation is too, suggesting the existence of a number of small monopolies. These elements may have allowed those producers to under-shift the tax to prices.

³¹E.g. <http://www.quiestlemoinscher.com/>, a price comparator run by Leclerc, and <http://www.garantieprixleplusbas.carrefour.fr/>, the equivalent for Carrefour.

al., 2013; Block et al., 2010; Lin et al., 2010).

Another important finding is the pervasive heterogeneity of the pass-through, not only across product categories, but also across beverage brands and across retailers. In particular, the pass-through for private label products is significantly larger than that observed for other brands. Since private label products are characterized by both lower average prices and higher pass-through, a larger impact of the soda tax on low income households seems likely. The full shifting of the tax observed on average thus results from the combination of an over-shifting for private labels and small producers' brands (at least for fruit drinks) and of an under-shifting of the tax in the case of large producers' brands. At the same time, we find that the two main retailing groups in France often passed through the soda tax less than the other ones. These results are shown to be consistent with a simple producer-retailer bargaining framework.

Overall, the absence of over-shifting of the excise, together with its limited magnitude (7.55 euro cents, corresponding to a price increase of 7% on average), allow to agree with Boizot-Szantal and Etilé (2012) and Bonnet and Réquillart (2013) regarding the expected low impact the soda tax in terms of sugar consumption and of its consequences on health.

Appendix A: More about the data base

Table A1: Composition of the sample by retail chain and group.

Retail chain	N. of shops	retailing group	Group market share
auchan	41	AUCHAN	10.9 %
simply market	38	AUCHAN	10.9 %
carrefour	2	CARREFOUR	18.7 %
carrefour market	1	CARREFOUR	18.7 %
casino	20	CASINO	5.0 %
geant casino	57	CASINO	5.0 %
leclerc	107	LECLERC	18.6 %
intermarche	179	LES MOUSQUETAIRES	12.6 %
ecomarche	3	LES MOUSQUETAIRES	12.6 %
hyper u	40	SYSTEME U	9.2 %
marche u	4	SYSTEME U	9.2 %
super u	263	SYSTEME U	9.2 %
u express	5	SYSTEME U	9.2 %
Total	760		75.0%

Sources: Pricing and, for retailing groups market shares, Kantar Worldpanel cited by Agromedia (2012) .

Table A2 : Composition of the sample by brand for waters

Brand	Market share	N. of shops	Products with added sugar or sweetener	Products with no added sugar nor sweetener
all private labels	20.1 %	508	x	x
cristaline	17.3 %	72	0	x
evian	6.3 %	581	0	x
volvic	5.9 %	583	x	x
contrex	5.0 %	485	x	x
salvetat	5.0 %	447	0	x
vittel	4.1 %	382	0	x
badoit	3.9 %	399	0	x
hepar	2.7 %	122	0	x
san pellegrino	2.5 %	264	x	x
quezac	2.1 %	207	0	x
st-yorre	1.9 %	181	0	x
st amand	1.8 %	94	0	x
courmayeur	1.2 %	152	0	x
vichy celestins	1.0 %	100	0	x
rozana	0.8 %	128	0	x
taillefine	0.4 %	61	x	0
perrier	0.1 %	364	0	x
other brands	17.9 %	417	0	x

Sources: Prixing and, for brand market shares, Rayon-boissons.com (<http://www.rayon-boissons.com/>), a professional website focusing on beverages.

Market share figures provided in the table combine market shares provided by Rayon-boissons.com for plain waters, sparkling waters and flavored waters separately.

Private labels include: achan, carrefour, casino, leclerc, intermarche and produit u.

Other brands include: abatilles, aix les bains, arcens, carola, lisbeth, mont dore, mont roucou, mont d'arrée, nestle, ogeu, pierval, plancoet, st antonin, spa, st alban, telle quelle, thonon, vals, vernière and wattwiller.

Table A3 : Composition of the sample by brand for fruit drinks

Brand	Market share in 2011	Market share used in the analysis	N. of shops	Products with added sugar or sweetener	Products with no added sugar nor sweetener
all private labels	56.5 %	48.0 %	562	x	x
oasis	-	11.0 %	565	x	0
tropicana	11.5 %	9.8 %	644	0	x
joker	11.2 %	9.5 %	408	x	x
lipton	-	4.0 %	365	x	0
pampryl	3.4 %	2.9 %	100	x	x
fruite	2.3 %	2.0 %	76	0	x
ocean spray	2.3 %	2.0 %	358	x	0
pressade	2.3 %	2.0 %	112	x	x
pago	1.1 %	1.0 %	89	x	x
rea	0.9 %	0.8 %	92	x	0
granini	0.4 %	0.3 %	38	x	0
other brands	7.3 %	6.7 %	600	x	x

Sources: Prixing and, for brand market shares, Rayon-boissons.com.

Market share figures published by Rayon-boissons.com slightly differ from those used in our analysis because, given their characteristics, two brands (Oasis and Lipton) were moved from the category ‘soda’ to the category ‘fruit drinks and ready to drink tea’.

Private labels include: auchan, carrefour, casino, leclerc, intermarche and produit u.

Other brands include: alter éco, andros, bjorg, brut de pomme, éthiquable, fanta, gayelord hauser, innocent, la ferme fruitière, minute maid, nestea, pulco, sunny delight, teisseire, tropico.

Table A4 : Composition of the sample by brand for sodas

Brand	Market share in 2011	Market share used in the analysis	N. of shops	Products with added sugar or sweetener	Products with no added sugar nor sweetener
all private labels	18.7 %	20.8 %	454	x	0
coca-cola	49.4 %	54.9 %	653	x	0
oasis	8.1 %	-	-	-	-
schweppes	4.4 %	4.9 %	596	x	0
orangina	4.0 %	4.4 %	525	x	0
lipton	2.8 %	-	-	-	-
fanta	2.7 %	3.0 %	443	x	0
pepsi	1.3 %	1.4 %	217	x	0
taillefine	1.0 %	1.1 %	249	x	0
seven up	0.9 %	1.0 %	189	x	0
sprite	0.9 %	1.0 %	320	x	0
red bull	0.6 %	0.7 %	298	x	0
other brands	6.1 %	6.8 %	490	x	0

Sources: Prixing and, for brand market shares, Rayon-boissons.com.

Market share figures published by Rayon-boissons.com slightly differ from those used in our analysis because, given their characteristics, two brands (Oasis and Lipton) were moved from the category 'soda' to the category 'fruit drinks and ready to drink tea'.

Private labels include : auchan, carrefour, casino, leclerc, intermarche and produit u.

Other brands include : breizh cola, burn, canada dry, dark dog, dr pepper, elsass cola, gini, kas, lorina, mirinda, monster, powerade, ricqlès, rivella, selecto, sumol, sun.

For the econometric analysis, Lipton was introduced into the category "Fruit drinks and ready-to-drink teas".

Web addresses of the sources:

1) total sales by product category:

<http://www.rayon-boissons.com/Chiffres-du-marche/Ventes-annuelles-de-boissons-sans-alcool-en-GMS-16474>

<http://www.rayon-boissons.com/Chiffres-du-marche/Ventes-d-eaux-embouteillees-en-GMS-20836>

2) market shares by product category:

<http://www.rayon-boissons.com/Chiffres-du-marche/Parts-de-marche-des-marques-d-eaux-plates-nature-en-GMS-20595>

<http://www.rayon-boissons.com/Chiffres-du-marche/Parts-de-marche-en-GMS-des-marques-d-eau-gazeuse-20969>

<http://www.rayon-boissons.com/Chiffres-du-marche/Parts-de-marche-des-marques-d-eaux-aromatisees-en-GMS-10521>

<http://www.rayon-boissons.com/Chiffres-du-marche/Parts-de-marche-annuelles-des-marques-de-jus-de-fruits-en-GMS-20023>

<http://www.rayon-boissons.com/Chiffres-du-marche/Parts-de-marche-des-principales-marques-de-sodas-20162>

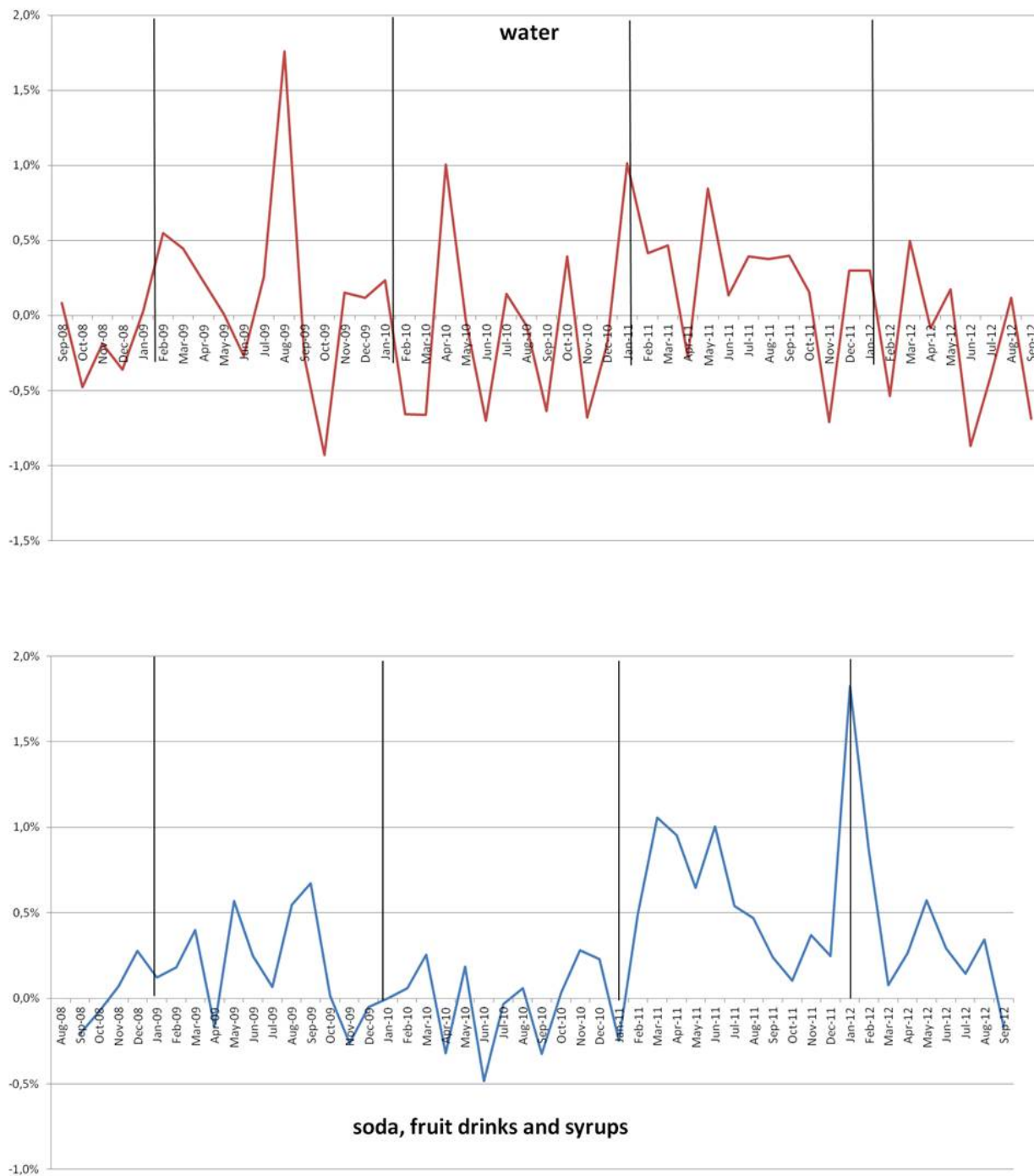
Appendix B: Main characteristics of the alternative econometric sample

Table B1: Descriptive statistics (November 2011 - June 2012 sample)

Product category:	Tax	N. obs. per month	N. of products	N. of shops	Mean price (euro/liter)		
					Nov.2011	Dec.2011	Jun.2012
Water	No	26244	195	955	0.50	0.50	0.50
	Yes	4152	32	865	0.78	0.78	0.83
Fruit drink	No	34675	330	951	1.74	1.74	1.76
	Yes	23224	198	946	1.20	1.20	1.27
Soda	Yes	43747	264	949	1.17	1.16	1.23

Appendix C: Seasonality

Figure C1: Monthly change in the French National Statistical Office series for water (first panel) and for sodas, fruit drinks and syrups (second panel).



References

- Agro-Media, 2012. Part de marché, Leclerc leader des enseignes de grande distribution. Available at <http://www.agro-media.fr/actualit%C3%A9/consommation/part-de-march%C3%A9-leclerc-leader-des-enseignes-de-grande-distribution>, last accessed September 14, 2012.
- Alviola, P.A., Capps, O., Wu, X., 2010. Micro-Demand Systems Analysis of Non-Alcoholic Beverages in the United States: An Application of Econometric Techniques Dealing With Censoring. 2010 Annual Meeting, Agricultural and Applied Economics Association.
- Anderson, S., De Palma, A., Kreider, B., 2001. Tax incidence in differentiated product oligopoly. *Journal of Public Economics* 81, (2), 173-192.
- Anderton, R., Meyler, A., Gattini, L., Izquierdo, M., Jarvis, V., Kaarup, R., Komzarkova, M., Landau, B., Mohr, M., Page, A., Sondermann, D., Vermeulen, P., Cornille, D., Tsalinski, T., Vladova, Z., Hartmann, C., Stahl, H., Linehan, S., Balfoussia, C., Panagiotou, S., de los Llanos Matea, M., Alvarez, L.J., Bardet-Fremann, P., Berardi, N., Sevestre, P., Ciapanna, E., Rondinelli, C., Kapatais, D., Walch, E., Lunnemann, P., Zerafa, S., Pace, C.S., Kieft, J., Fritzer, F., Cardoso, F., Gabrijelcic, M., Karma, B., Kivisto, J., 2011. Structural features of distributive trades and their impact on prices in the euro area. *European Central Bank Occasional Paper Series* 128.
- Baudry, L., Le Bihan, H., Sevestre, P., Tarrieu, S., 2007. What do thirteen million price records have to say about consumer price rigidity?. *Oxford Bulletin of Economics and Statistics* 69 (2), 139-183.
- Berardi, N., Gautier, E., Le Bihan, H., 2013. More facts about prices: France before and during the great recession. *Banque de France Working Paper* 425.
- Berardi, N., Sevestre, P., Tépaut, M., Vigneron, A., 2012. The impact of a ‘soda tax’ on prices. Evidence from French micro data. *Banque de France Working Paper* 415.
- Bergman, U.M., Hansen, N.L., 2013. Are excise taxes on beverages fully passed through to prices? The Danish evidence. Mimeo.
Available at <http://www.econ.ku.dk/okombe/MBNLH.pdf>, last accessed April 17, 2014
- Bergès-Sennou, F., Bontems, P., Réquillart, V., 2004. Economics of private labels: a survey of literature. *Journal of Agricultural and Food Industrial Organization* 2 (3), 1-25.
- Besley, T., Rosen, H., 1999. Sales taxes and prices: an empirical analysis. *National Tax Journal* 52 (2), 157-178.
- Block, J.P., Chandra, A., Manues, K.D., Willett, W.C., 2010. Point-of-purchase price and education intervention to reduce consumption of sugary drinks. *American Journal*

of Public Health 100 (8), 1427-1433.

Boizot-Szantai, C., Etilé, F., 2011. Taxer les boissons sucrées pour lutter contre l'obésité? Le point de vue de l'Economie. *Obésité* 6 (4), 218-225.

Bonnet, C., Dubois, P., 2010. Non-linear contracting and endogenous buyer power between manufacturers and retailers: empirical evidence on food retailing in France. TSE working Paper 10-189.

Bonnet, C., Réquillart, V., 2011. Strategic pricing and health price policies. TSE working Paper 11-233.

Bonnet, C., Réquillart, V., 2013. Tax incidence with strategic firms in the soft drink market. *Journal of Public Economics* 106, 77-88.

Bridging the Gap Program, 2011. State sales tax on regular, sugar-sweetened soda (as of July 1, 2011). Robert Wood Johnson Foundation.

Available at http://www.bridgingthegapresearch.org/_asset/zvh93o/

BTG_State_Soda_Sales_Tax_Jul012011_publuse_29Nov11.pdf. last accessed February 11, 2013

Brownell, K.D., Farley, T., Willett, W.C., Popkin, B.M., Chaloupka, F.J., Thompson, J.W., Ludwig, D.S., 2009. The public health and economic benefits of taxing sugar-sweetened beverages. *New England Journal of Medicine* 361, 1599-1605.

Carbonnier, C., 2007. Who pays sales taxes? Evidence from French VAT reforms, 1987-1999. *Journal of Public Economics* 91, 1219-1229.

Chiou, L., Muehlegger, E., 2010. Consumer response to cigarette excise tax changes. Harvard Kennedy School Research Working Paper June 2010.

Cotterill, R.W., Franklin, A.W., Ma, L.Y., 1996. Measuring market power effects in differentiated product industries: an application to the soft drink industry. Food Marketing Policy Center research report 32, University of Connecticut.

Dauvers, O., 2012. Drive'Insights Septembre 2012. Editions A3ditrib/Editions Dauvers.

Dauvers, O., 2013a. Drive'Insights Janvier 2013. Editions A3ditrib/Editions Dauvers.

Dauvers, O., 2013b. Drive'Insights Décembre 2013. Editions A3ditrib/Editions Dauvers.

Dauvers, O., 2014. Transparence des prix. Available at <http://www.olivierdauvers.fr/wp-content/uploads/2014/03/PrixCoca1.jpg>

De Cicca, P., Kenkel, D., Liu, F., 2013. Who Pays Cigarette Taxes? The Impact of Consumer Price Search. *The Review of Economics and Statistics* 95 (2), 516-529.

Delipalla, S., Keen, M., 1992. The comparison between ad valorem and specific taxation under imperfect competition. *Journal of Public Economics* 49 (3), 351-367.

- Dharmasena, S., Capps, O., 2012. Intended and unintended consequences of a proposed national tax on sugar-sweetened beverages to combat the US obesity problem. *Health Economics* 21, 669-694.
- Doyle, J.J., Samphantharak, K., 2008. \$2.00 Gas! Studying the effects of a gas tax moratorium. *Journal of Public Economics* 92, 869-884.
- Dube, J.P., 2005. Product differentiation and mergers in the carbonated soft drink industry. *Journal of Economics and Management Industry* 14 (14), 879-904.
- Eichenbaum, M., Jaimovich, N., Rebelo, S., 2011. Reference prices, costs and nominal rigidities. *American Economic Review* 101, 234-262.
- Finkelstein, E.A., Zhen, C., Bilger, M., Nonnemaker, J., Farooqui, A.M., Todd, J., 2013. Implications of a sugar-sweetened beverage (SSB) tax when substitutions to non-beverage items are considered. *Journal of Health Economics* 32, 219-239.
- Fletcher, J.M., Frisvold, D.E., Teddf, N., 2010. The effects of soft drink taxes on child and adolescent consumption and weight outcomes. *Journal of Public Economics* 94, 967-974.
- Fullerton, D., Metcalf, G., 2002. Tax incidence. *Handbook of Public Economics* 4, 1787-1872.
- Gasmi, F., Laffont, J.J., Vuong, Q., 1992. Econometric analysis of collusive behavior in a soft drink market. *Journal of Economics and Management Industry* 12 (1), 277-311
- Hanson, A., Sullivan, R., 2009. The incidence of tobacco taxation: Evidence from geographic micro-level data. *National Tax Journal* 62 (4), 677-698.
- Harding, M., Leibtag, E., Lovenheim, M.F., 2012. The heterogeneous geographic and socio-economic incidence of cigarette taxes: Evidence from Nielsen Homescan data. *American Economic Journal, Economic Policy* 4 (4), 169-198.
- Jacobson, M.F., Brownell, K.D., 2000. Small taxes on soft drinks and snack food to promote health. *American Journal of Public Health* 90 (6), 854-857.
- Kenkel, D.S., 2005. Are alcohol tax hikes fully passed through to prices? Evidence from Alaska. *American Economic Review* 95 (2), 273-277.
- Lin, B.H., Smith, T.A., Lee, J.Y., 2010. Effects of taxing sugar-sweetened beverage and subsidizing milk: beverage consumption, nutrition, and obesity among US children. 115th Joint EAAE/AAEA Seminar, European Association of Agricultural Economists.
- Marion, J., Muehlegger, E., 2011. Fuel tax incidence and supply conditions. *Journal of Public Economics* 95, 1202-1212.
- Neuville, M., 2009. Les caractéristiques des formules de distribution alimentaire. Available at <http://www.distripedie.com/distripedie/spip.php?article978>
- OECD, 2012. Obesity update 2012. Available at <http://www.oecd.org/health/healthpoliciesanddata/49716427.pdf>, last accessed

February 11, 2013.

Pofahl, G. M., Capps, O., Clauson, A., 2005. Demand for Non-Alcoholic Beverages: Evidence from the ACNielsen Home Scan Panel. 2005 Annual Meeting, Agricultural and Applied Economics Association.

Smith, T.A., Lin, B.H., Lee, J.Y., 2010. Taxing caloric sweetened beverages. Potential effects on beverage consumption, calorie intake, and obesity. USDA Economic Research Report 100.

Stern, N., 1987. The effects of taxation, price control and government contracts in oligopoly and monopolistic competition. *Journal of Public Economics* 32 (2), 133-158.

Young, D., Bieliska-Kwapisz, A., 2002. Alcohol taxes and beverage prices. *National Tax Journal* 55 (1), 57-73.

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